DRUM-TYPE LAUNDRY MACHINE

BACKGROUND OF THE INVENTION

Field of the Invention

The present invention relates to a drum-type laundry machine which is adapted to accommodate and wash laundry in a drum thereof.

Description of Related Art

A drum-type laundry machine is known, which is adapted to accommodate and wash laundry in a generally cylindrical drum rotatable about a generally horizontal axis. The laundry machine of this type comprises, for example, an outer tub surrounding the drum. The laundry machine is adapted to rotate the drum with a predetermined amount of water contained in the outer tub, and repeat such an operation (slam-washing operation) as to lift the laundry in the drum by baffles projecting inwardly of the interior surface of the drum and drop the laundry from a certain height toward the surface of the water by gravity.

In the conventional ordinary drum-type laundry machine, the drum and the outer tub are disposed in a housing with their opposite end faces oriented anteriorly and posteriorly of the laundry machine. An outer lid to be opened and closed for loading and unloading the laundry is provided on a front face of the housing. An inner lid

and a drum lid are provided on front end faces of the outer tub and the drum, respectively. With the outer lid, the inner lid and the drum lid being all open, the laundry is taken into and out of the drum from the front side of the drum-type laundry machine.

In the case of the aforesaid conventional drum-type laundry machine, however, a user should stoop down for taking the laundry in and out of the drum, because the outer lid is provided on the front face of the housing. This makes the loading and unloading of the laundry difficult.

To solve this drawback, there has been proposed a drum-type laundry machine having an outer lid provided on a top face of a housing thereof (see, for example, Sanyo Electric's "Laundry Machine and Clothes Dryer Catalog (2002 winter)", p.1-6). In this drum-type laundry machine, a drum and an outer tub are disposed in the housing, for example, with their opposite end faces being oriented laterally. An inner lid and a drum lid are provided on circumferences of the outer tub and the drum, respectively. In the case of this drum-type laundry machine, the user can insert his/her hands into the drum from the diagonally upper side with the outer lid, the inner lid and the drum lid being all open, and assume an easy attitude for taking the laundry in and out of the drum.

In the drum-type laundry machine, the housing has an anteroposteriorly elongated opening to be covered and uncovered by the outer lid for facilitating the loading and unloading of the laundry. Accordingly, the outer lid needs to have an anteroposteriorly elongated shape. In the present drum-type laundry machine, the outer lid has a foldable structure, so that the opening of the housing can widely be opened by compactly folding the outer lid rearwardly of the housing.

More specifically, the outer lid includes a rear lid which covers a rear portion of the opening of the housing, and a front lid which covers a front portion of the opening of the housing. The rear lid is pivotally attached along its rear edge to a top face of the housing, and the front lid is pivotally attached along its rear edge to a front edge of the rear lid. The user holds a handle provided on the front lid, and slides the front lid rearward while lifting a rear portion of the front lid. Thus, the outer lid is folded with the front lid and the rear lid thereof projecting upward.

In the case of the aforesaid drum-type laundry machine, however, the front lid should anteroposteriorly be slid for a long distance by holding the handle of the front lid for covering and uncovering the opening of the housing, because the opening of the housing has an

anteroposteriorly elongated shape (particularly because the opening is inclined for easy loading and unloading of the laundry and, hence, has a greater length). Therefore, it is desirable to provide a construction which allows for easier opening and closing of the outer lid.

In the case of the aforesaid drum-type laundry machine, the outer lid is folded to be opened, and then the inner lid is opened. At this time, the inner lid is opposed to the front side of the folded outer lid. In order to sufficiently open the inner lid, the outer lid should be adapted to be tilted rearward in a folded state. With this arrangement, however, there is a possibility that the outer lid hits against a faucet projecting from a wall for supplying water into the drum-type laundry machine, if the drum-type laundry machine is installed with a rear face of the housing thereof fitted along the wall.

SUMMARY OF THE INVENTION

In view of the foregoing, it is an object of the present invention to provide a drum-type laundry machine which ensures that a lid (outer lid) thereof can more advantageously be opened and closed.

According to an inventive aspect as set forth in claim 1 to achieve the aforesaid object, there is provided a drum-type laundry machine (1; 100), which comprises:

a drum (10) rotatable about a rotation shaft (11) extending at an angle within a predetermined angular range with respect to a horizontal axis, the drum having an opening (22) formed in a circumference thereof for loading and unloading of laundry; a housing (2; 200, 210) defining an outer shape of the drum-type laundry machine and accommodating the drum therein, the housing having an inlet opening (4) provided in a top face (2A; 211, 212) thereof and permitting access to the opening of the drum for the loading and unloading of the laundry; and a slide lid (31; 35; 38) which is slidable along the inlet opening for covering and uncovering the inlet opening.

The parenthesized alphanumeric characters respectively represent components to be described later in embodiments. The same definition is applied to the following description.

With this arrangement, the lid (slide lid) is, for example, accommodated in the housing so not as to project out of the housing, unlike the conventional drum-type laundry machine having the two lids which are foldable to project upward from the top face of the housing. Therefore, there is no possibility that the lid of the drum-type laundry machine hits against a faucet projecting from a wall for supplying water into the drum-type laundry machine, even if the drum-type laundry machine is installed

with a rear face of the housing thereof fitted along the wall. Thus, the opening and closing of the lid can more advantageously be achieved.

According to an inventive aspect as set forth in claim 2, the drum-type laundry machine (1; 100) of claim 1 is characterized in that: the top face (2A; 211; 212) of the housing (2; 200, 210) includes an oblique face (2B; 212) inclined forwardly downward; the inlet opening (4) extends from a front portion of the oblique face to a rear portion of the top face; and the slide lid (31; 38) is slid rearward from a front edge of the inlet opening to uncover the inlet opening, and is slid forward to the front edge of the inlet opening to cover the inlet opening.

With this arrangement, the lid (slide lid) needs to have an anteroposteriorly elongated shape for covering the anteroposteriorly elongated opening which extends from the top face to the oblique face of the housing. With the aforesaid arrangement, however, the lid is prevented from projecting from the housing, for example, by accommodating the lid in the housing. Therefore, even if the drum-type laundry machine is installed with the rear face of the housing thereof fitted along the wall, the outer lid of the drum-type laundry machine is effectively prevented from hitting against the faucet projecting from the wall for supplying water into the

drum-type laundry machine, as compared with the conventional drum-type laundry machine which has the two lids foldable to project upward from the top face of the housing. Thus, the opening and closing of the lid can more advantageously be achieved.

The slide lid (31; 38) may be constructed so that a force is applied to the slide lid in a lid opening direction when the slide lid is opened from a closed state to a predetermined position. In this case, the lid (slide lid) is merely opened from the closed state to the predetermined position, whereby the lid is thereafter automatically opened. Thus, the lid can more easily be opened.

The slide lid (31; 38) may be constructed so that a force is applied to the slide lid in a lid closing direction when the slide lid is closed from an open state to a predetermined position. In this case, the lid (slide lid) is merely closed from the open state to the predetermined position, whereby the lid is thereafter automatically closed. Thus, the lid can more easily be closed.

The forces may be applied to the slide lid (31; 38) by gravity acting on the slide lid or by biasing means (springs or the like).

According to an inventive aspect as set forth in claim 3, the drum-type laundry machine (100) of claim 2 is characterized in that the top face of the housing (200,

210) further includes another oblique face (211) inclined rearwardly downward, and convexly projects upward so as to have the greatest height at an anteroposteriorly predetermined position.

The top face of the housing (200, 210) may further include a curved face (214) extending continuously rearward from the oblique face (211) and smoothly curved for slidably guiding the slide lid (38) rearwardly downward.

With this arrangement, when the slide lid is opened, the slide lid slid rearward can be guided obliquely toward the curved face along the oblique face inclined rearwardly downward. Since a curved portion of the curved face has a greater curvature radius, the slide lid can more smoothly be guided downward along the curved face.

According to an inventive aspect as set forth in claim 4, the predetermined position may be a rearward position, and the oblique faces may each have a convexly curved surface. In this case, the slide lid can more smoothly be guided rearward.

According to an inventive aspect as set forth in claim 5, the drum-type laundry machine (1) of claim 1 is characterized in that the slide lid (35) has a first lid (351) and a second lid (352), and further comprises a coupling mechanism (354, 355) for opening and closing the

first and second lids in association with each other.

With this arrangement, when one of the first and second lids is slid, the other lid is also slid for covering and uncovering the opening. Thus, the opening and closing of the lid can more easily be achieved.

According to an inventive aspect as set forth in claim 6, the drum-type laundry machine (100) of any of claims 1 to 5 further comprises: a guide member (213A) engaged with a side edge of the slide lid (38) for guiding the slide lid in a lid sliding direction; and a restriction member (232, 217, 383B, 383C, 38D) for restricting displacement of the slide lid in a direction intersecting the lid sliding direction so as to prevent the side edge of the slide lid from disengaging from the guide member.

With this arrangement, the restriction member prevents the side edge of the slide lid from disengaging from the guide member, even if a force is applied in the direction intersecting the sliding direction (e.g., laterally) when a user opens and closes the slide lid. Thus, the opening and closing of the slide lid can more advantageously be achieved.

According to an inventive aspect as set forth in claim 7, the drum-type laundry machine (1; 100) of claim 6 is characterized in that the slide lid (31; 35; 38) is bendable in the sliding direction along the inlet opening

(4) and the housing (2; 200, 210).

With this arrangement, even if edges of the opening are not straight (curved), the opening can properly be covered by the lid (slide lid) which is bendable along the opening.

The slide lid (31; 35; 38) may comprise elongate members (31A; 351A, 352A; 381) arranged in parallel relation and connected to one another by a flexible member (like a bath tub lid).

According to an inventive aspect as set forth in claim 8, the drum-type laundry machine (100) of claim 7 is characterized in that the slide lid (38) is accommodated in a suspended state in a rear portion of the housing (200, 210) while the slide lid is opened.

With this arrangement, the slide lid can be accommodated in a vertically elongate narrow space defined in the rear portion of the housing.

According to an inventive aspect as set forth in claim 9, the drum-type laundry machine (100) of claim 8 further comprises a guide surface (71A) for guiding the slide lid (38) so as to suspend the slide lid in the rear portion of the housing (200, 210) when the slide lid is opened.

With this arrangement, the slide lid to be slid in the suspended state from the upper rear side of an outer

tub into the rear portion of the housing can smoothly be guided downward along the guide surface. Thus, the opening and closing of the slide lid can more advantageously be achieved.

According to an inventive aspect as set forth in claim 10, the drum-type laundry machine (100) of claim 9 is characterized in that the guide surface (71A) projects rearwardly of a component disposed within the housing (200, 210) to prevent the slide lid (38) from interfering with the component.

With this arrangement, the slide lid is prevented from interfering with the component disposed within the housing (e.g., a rib and the like) disposed on the outer circumference of the outer tub), so that the slide lid can assuredly be accommodated in the rear portion of the housing (behind the outer tub). Thus, the opening and closing of the slide lid can more advantageously be achieved.

According to an inventive aspect as set forth in claim 11, the drum-type laundry machine (100) of claim 7 is characterized in that the slide lid (38) comprises a main body (381), and a flexible sheet member (382) which covers an upper surface of the main body and is bendable in accordance with the bending of the slide lid.

With this arrangement, where the slide lid is

constructed such that a plurality of elongate members (bar members) are connected to one another in parallel relation like a bath tub lid, dust is prevented from intruding into recesses defined on connections between the respective bar members.

Further, the slide lid with the upper surface of the main body thereof covered with the sheet member has an improved appearance as compared with the slide lid constructed such that the plural bar members thereof connected to one another are exposed like a bath tub lid.

Further, the design of the drum-type laundry machine can be improved by drawing a pattern or the like on an upper surface of the sheet member.

According to an inventive aspect as set forth in claim 12, the drum-type laundry machine (100) of claim 11 is characterized in that the sheet member (382) is attached to the main body (381) of the slide lid (38) with a predetermined amount of slack provided in the lid sliding direction (anteroposteriorly).

With this arrangement, when the slide lid is bent, the sheet member is prevented from being raised from the upper surface of the main body of the slide lid by warpage which may otherwise occur due to displacement thereof with respect to the main body of the slide lid.

The sheet member (382) may have an elongate hole

(382B) extending in the lid sliding direction, and a fixture (384) may be attached to the main body (381) through the elongate hole.

According to an inventive aspect as set forth in claim 13, a foreign matter intrusion preventing member (223; 385) may be provided in a gap defined between the upper surface of the slide lid and the housing for preventing a foreign matter (a relatively thin matter such as a coin) from intruding into the rear portion of the housing (200, 210) along the upper surface of the slide lid (38).

In this case, the foreign matter intrusion preventing member may comprise a resilient member (223) provided in sliding contact with the upper surface of the slide lid (38), or a projection (385) projecting from the upper surface of the slide lid (38).

According to an inventive aspect as set forth in claim 14, the drum-type laundry machine (100) of any of claims 1 to 13 further comprises an electric opening/closing mechanism (300, 400) for electrically opening and closing the slide lid (38).

With this arrangement, the opening and closing of the slide lid can easily be achieved, as compared with a case where the slide lid is manually opened and closed.

The electric opening/closing mechanism (300, 400)

may comprise a lid opening button (52) which is pressed for opening the slide lid (38).

According to an inventive aspect as set forth in claim 15, the drum-type laundry machine (100) of claim 14 comprises a start button (51) for starting an operation (a washing process and the like) of the drum-type laundry machine, wherein the electric opening/closing mechanism (300, 400) closes the slide lid (38) in response to pressing of the start button.

With this arrangement, the slide lid is automatically closed and the operation is started simply by pressing the start button after the laundry is loaded in the drum. Thus, the convenience of the laundry machine can be improved.

The drum-type laundry machine may further comprise a drum lid (25) for opening and closing the drum (10), and an inner lid (24) for opening and closing the outer tub (7), wherein the drum lid is opened in association with the opening of the inner lid.

The electric opening/closing mechanism (300) may comprise a stepping motor (M1).

The electric opening/closing mechanism (400) may comprise a torque motor (M2), and a slide lid sensor (MS, LS) for detecting the opening and closing of the slide lid (38), wherein rotative driving of the torque motor

is stopped on the basis of a detection signal from the slide lid sensor.

In this case, the electric opening/closing mechanism (400) may further comprise a lock device (L) for locking the slide lid (38) in the closed state when the slide lid sensor (MS, LS) detects the closed state of the slide lid.

According to an inventive aspect as set forth in claim 16, the drum-type laundry machine (100) of claim 14 or 15 further comprises an open/close lid (24) provided in the housing (200, 210) to be opened and closed when the laundry is taken into or out of the drum, and an open/close sensor (24A) for detecting whether the open/close lid is closed, wherein the electric opening/closing mechanism (300, 400) permits the slide lid (38) to be closed when the open/close sensor detects that the open/close lid is closed.

This arrangement prevents the slide lid from being closed with the open/close lid being in an open state when the user forgets to close the open/close lid. Thus, the slide lid is prevented from being damaged in collision against the open/close lid in the open state.

The open/close lid may be the drum lid (25) for opening and closing the drum (10), or the inner lid (24) for opening and closing the outer tub (7).

According to an inventive aspect as set forth in claim 17, the drum-type laundry machine (100) of any of claims 1 to 16 further comprises a water supply valve (V) which is opened for introducing tap water into the laundry machine, and a bath water pump (P) which is driven for introducing bath water into the laundry machine, wherein the water supply valve is disposed on one side (on the left side) of a slide lid slidable region (214) where the slide lid (38) is slidable in the lid sliding direction (anteroposteriorly), and wherein the bath water pump is disposed on the other side (on the right side) of the slide lid slidable region.

With this arrangement, the water supply valve and the bath water pump are disposed outside the slide lid slidable region, whereby the water supply valve and the bath water pump are prevented from interfering with the opening and closing of the slide lid. Thus, the opening and closing of the slide lid can advantageously be achieved.

Since the water supply valve and the bath water pump are disposed in free spaces defined on the opposite sides of the slide lid slidable region, there is no need to increase the size of the drum-type laundry machine for providing the water supply valve and the bath water pump.

According to an inventive aspect as set forth in claim 18, there is provided a drum-type laundry machine

(1), which comprises: a drum (10) rotatable about a rotation shaft (11) extending at an angle within a predetermined angular range with respect to a horizontal axis, the drum having an opening (22) formed in a circumference thereof for loading and unloading of laundry; a housing (2) defining an outer shape of the drum-type laundry machine and accommodating the drum therein, the housing having an inlet opening (4) provided in a top face (2A) thereof and permitting access to the opening of the drum for the loading and unloading of the laundry; an open/close lid (32) for covering the inlet opening; biasing means (325) for biasing the open/close lid in a lid opening direction; and holding means (326) for holding the open/close lid in a closed state for preventing the open/close lid from being opened.

With this arrangement, the lid (open/close lid) can be opened through a one-touch operation simply by releasing the lid from the holding means. This eliminates the need for sliding the lid from one edge to the other edge of the opening for opening the lid. Thus, the opening and closing of the lid can more easily (advantageously) be achieved.

The open/close lid (32) may comprise a plurality of lid pieces (321, 322) connected to one another in a foldable manner.

The drum-type laundry machine may further comprise

a damper for preventing the open/close lid (32) from being impetuously opened. With this arrangement, the lid is prevented from being impetuously opened to be damaged. Thus, the opening and closing of the lid can advantageously be achieved.

According to an inventive aspect as set forth in claim 19, there is provided a drum-type laundry machine (1), which comprises: a drum (10) rotatable about a rotation shaft (11) extending at an angle within a predetermined angular range with respect to a horizontal axis, the drum having an opening (22) formed in a circumference thereof for loading and unloading of laundry; a housing (2) defining an outer shape of the drum-type laundry machine and accommodating the drum therein, the housing having an inlet opening (4) provided in a top face (2A) thereof and permitting access to the opening of the drum for the loading and unloading of the laundry; an open/close lid (33) for covering the inlet opening; and biasing means (336) for biasing the open/close lid, the biasing means being adapted to apply no biasing force to the open/close lid in a lid opening direction when the open/close lid is in a closed state and to apply a biasing force to the open/close lid in the lid opening direction when the open/close lid is opened to a predetermined position.

With this arrangement, when the lid (open/close lid)

is opened from the closed state to the predetermined position, the biasing force is applied to the lid in the lid opening direction by the biasing means. That is, if the biasing force to be applied by the biasing means is set greater, the lid can automatically be opened after the lid is opened to the predetermined position. On the other hand, if the biasing force to be applied by the biasing means is set smaller, the lid can be opened with a smaller magnitude of force after the lid is opened to the predetermined position. Thus, the opening and closing of the lid can more easily (advantageously) be achieved.

The open/close lid (33) may comprise a plurality of lid pieces (331, 332) connected to one another in a foldable manner. In this case, the biasing means (336) may be adapted to bias the plurality of lid pieces in a lid folding direction.

The drum-type laundry machine may further comprise restriction means (332A, 335B) for preventing the open/close lid (33) from being opened beyond a predetermined extent.

The drum-type laundry machine may further comprise a damper for preventing the open/close lid (33) from being impetuously opened. In this case, the lid is prevented from being impetuously opened to be damaged. Thus, the opening and closing of the lid can advantageously be

achieved.

According to an inventive aspect as set forth in claim 20, there is provided a drum-type laundry machine (1), which comprises: a drum (10) rotatable about a rotation shaft (11) extending at an angle within a predetermined angular range with respect to a horizontal axis, the drum having an opening (22) formed in a circumference thereof for loading and unloading of laundry; a housing (2) defining an outer shape of the drum-type laundry machine and accommodating the drum therein, the housing having an inlet opening (4) provided in a top face (2A) thereof and permitting access to the opening of the drum for the loading and unloading of the laundry; a first lid piece (342) pivotally attached along one of opposite edges thereof to the housing for covering a portion of the inlet opening; a second lid piece (341) pivotally attached to the other edge of the first lid piece for covering the other portion of the inlet opening; and guide means (345, 4A) for guiding an edge of the second lid piece opposite from the first lid piece along the inlet opening.

With this arrangement, the opposite edges of the lid (including the first and second lid pieces) are engaged with the housing, so that the lid is prevented from being twisted when the lid is opened and closed. Hence, the lid can smoothly be opened and closed. Thus, the opening

and closing of the lid can advantageously be achieved.

The drum-type laundry machine may further comprise arresting means (347) for arresting the first and second lid pieces (341, 342) at a given position. In this case, the lid is prevented from being automatically closed by gravity when the user lets his/her hand off the lid in the opening or closing of the lid. Thus, the lid is less liable to be damaged.

According to an inventive aspect as set forth in claim 21, there is provided a drum-type laundry machine (1), which comprises: a drum (10) rotatable about a rotation shaft (11) extending at an angle within a predetermined angular range with respect to a horizontal axis, the drum having an opening (22) formed in a circumference thereof for loading and unloading of laundry; a housing (2) defining an outer shape of the drum-type laundry machine and accommodating the drum therein, the housing having an inlet opening (4) provided in a top face (2A) thereof and permitting access to the opening of the drum for the loading and unloading of the laundry; and an open/close lid (36) for covering the inlet opening, the open/close lid comprising a plurality of lid pieces (361, 362) connected to one another in a foldable manner, one of the lid pieces (362) being attached to (the top face of) the housing so as to be pivotal in a direction intersecting a lid piece

connection direction in which the lid pieces are connected to one another.

With this arrangement, the plurality of lid pieces are pivotal in the direction (e.g., laterally) intersecting the lid piece connection direction (e.g., anteroposteriorly). Hence, there is no need to slide the lid for a long distance between opposite edges of the opening in the opening and closing of the lid (open/close lid), so that the lid can more easily be opened and closed. Thus, the opening and closing of the lid can more advantageously be achieved.

By offsetting the lid pivoting direction (e.g., lateral direction) from the lid piece connection direction (e.g., anteroposterior direction), the lid is prevented from hitting against a faucet projecting from a wall for supplying water into the drum-type laundry machine, even if the drum-type laundry machine is installed with a rear face of the housing thereof fitted along the wall.

According to an inventive aspect as set forth in claim 22, there is provided a drum-type laundry machine (1), which comprises: a drum (10) rotatable about a rotation shaft (11) extending at an angle within a predetermined angular range with respect to a horizontal axis, the drum having an opening (22) formed in a circumference thereof for loading and unloading of laundry; a housing (2) defining

an outer shape of the drum-type laundry machine and accommodating the drum therein, the housing having an inlet opening (4) provided in a top face (2A) thereof and permitting access to the opening of the drum for the loading and unloading of the laundry; and an open/close lid (37) for covering the inlet opening, the open/close lid comprising a first lid piece (372) and a second lid piece (371) connected to each other in a foldable manner, the first lid piece being pivotally attached along a rear edge thereof to (the top face of) the housing in association with a rear edge of the inlet opening; wherein the first lid piece covers a relatively great portion of the inlet opening and has a relatively great depth; wherein the second lid piece covers a relatively small portion of the inlet opening and has a relatively small depth; wherein, when the open/close lid is in an open state, the first lid piece projects upward from the top face of the housing, and the second lid piece is folded as extending downward from an upper edge of the first lid piece to a middle portion of the first lid piece (as being overlapped with the first lid piece).

With this arrangement, the gravity center of the lid (open/close lid) can be shifted rearward, as compared with the conventional lid which is constructed so that the front lid is folded as being opposed to the entire

forward face of the rear lid. Therefore, even if the pivot angle of the lid (the rearward inclination angle of the lid) is relatively small, the lid can be held in the folded state. Hence, even if the drum-type laundry machine is installed with a rear face of the housing thereof fitted along a wall, the lid is prevented from hitting against a faucet projecting from the wall for supplying water into the drum-type laundry machine. Thus, the opening and closing of the lid can advantageously be achieved.

According to an inventive aspect as set forth in claim 23, the drum-type laundry machine of claim 22 further comprises: an outer tub (7) fixedly disposed in the housing (2) and surrounding the drum (10); an inner opening (23) provided in association with the inlet opening (4) of the outer tub; and an inner lid (24) pivotally attached along one edge thereof to the outer tub for covering and uncovering the inner opening; wherein, when the inner lid is in an open state, the inner lid projects upward with an upper edge thereof being in non-overlapping relation with the folded second lid piece (371).

With this arrangement, even if the pivot angle of the lid (open/close lid) is relatively small, the inner lid can sufficiently be opened, as compared with the conventional lid which is constructed so that the inner lid is opposed to the forward side of the two folded lids.

Therefore, even if the drum-type laundry machine is installed with the rear face of the housing thereof fitted along the wall, the lid is prevented from hitting against the faucet projecting from the wall for supplying water into the drum-type laundry machine. Thus, the opening and closing of the lid can advantageously be achieved.

The drum-type laundry machine may further comprise restriction means (375B, 375C) for preventing the open/close lid (37) from being opened beyond a predetermined extent.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a perspective view illustrating the exterior of a drum-type laundry machine according to one embodiment of the present invention;

Fig. 2 is a vertical sectional view of the drum-type laundry machine;

Fig. 3 is a vertical sectional view illustrating an outer lid in a closed state for explaining the construction of the outer lid according to a first embodiment;

Fig. 4 is a vertical sectional view illustrating the outer lid in an open state for explaining the construction of the outer lid according to the first embodiment;

Fig. 5 is a vertical sectional view illustrating

an outer lid in a closed state for explaining the construction of the outer lid according to a second embodiment;

Fig. 6 is a vertical sectional view illustrating the outer lid in an open state for explaining the construction of the outer lid according to the second embodiment;

Fig. 7 is a vertical sectional view illustrating an outer lid in a closed state for explaining the construction of the outer lid according to a third embodiment;

Fig. 8 is a vertical sectional view illustrating the outer lid in a half-open state for explaining the construction of the outer lid according to the third embodiment;

Fig. 9 is a vertical sectional view illustrating the outer lid in a full-open state for explaining the construction of the outer lid according to the third embodiment;

Fig. 10 is a vertical sectional view illustrating an outer lid in a closed state for explaining the construction of the outer lid according to a fourth embodiment;

Fig. 11 is a vertical sectional view illustrating the outer lid in a half-open state for explaining the

construction of the outer lid according to the fourth embodiment;

Fig. 12 is a vertical sectional view illustrating the outer lid in a full-open state for explaining the construction of the outer lid according to the fourth embodiment;

Fig. 13 is a vertical sectional view illustrating an outer lid in a closed state for explaining the construction of the outer lid according to a fifth embodiment;

Fig. 14 is a vertical sectional view illustrating the outer lid in an open state for explaining the construction of the outer lid according to the fifth embodiment;

Fig. 15 is a plan view illustrating an outer lid in a closed state for explaining the construction of the outer lid according to a sixth embodiment;

Fig. 16 is a plan view illustrating the outer lid in an open state for explaining the construction of the outer lid according to the sixth embodiment;

Fig. 17 is a vertical sectional view illustrating an inner lid and an outer lid in a closed state for explaining the construction of the outer lid according to a seventh embodiment;

Fig. 18 is a vertical sectional view illustrating

the inner lid and the outer lid in an open state for explaining the construction of the outer lid according to the seventh embodiment;

Fig. 19 is a perspective view illustrating the exterior of a drum-type laundry machine according to an eighth embodiment of the present invention;

Fig. 20 is an enlarged partial side view for explaining the construction of an outer lid;

Fig. 21 is a vertical sectional view of the drum-type laundry machine;

Fig. 22 is a sectional view of the outer lid laterally taken along a bar member and seen from the front side for explaining an arrangement for attaching the outer lid;

Fig. 23 is a sectional view of the outer lid laterally taken along a handle and seen from the front side for explaining the arrangement for attaching the outer lid;

Fig. 24 is a plan view of the outer lid;

Fig. 25 is an enlarged partial vertical sectional view illustrating the surroundings of a rear cover of the drum-type laundry machine;

Fig. 26 is a diagram illustrating a variation of an arrangement for preventing intrusion of foreign matter in the rear cover;

Fig. 27 is a plan view illustrating the drum-type laundry machine with the rear cover removed;

Fig. 28 is a schematic diagram illustrating a first variation of an outer lid opening/closing mechanism;

Fig. 29 is a schematic diagram illustrating a second variation of an outer lid opening/closing mechanism;

Fig. 30 is a vertical sectional view illustrating the surroundings of a handle for explaining an outer lid opening/closing mechanism including sled members as slide assist members according to a ninth embodiment;

Fig. 31 is a vertical sectional view illustrating the surroundings of the handle for explaining a variation of the slide assist members including roller members;

Fig. 32 is a vertical sectional view illustrating a front portion of a top cover with the outer lid being closed;

Fig. 33 is a vertical sectional view illustrating the surroundings of the handle for explaining a fixture arrangement for fixing the handle to the outer lid;

Fig. 34 is an enlarged vertical sectional view illustrating the surroundings of the rear cover for explaining the detailed construction of a rear portion of the top cover covered with the rear cover;

Fig. 35 is a plan view illustrating the outer lid as seen from the back side; and

Fig. 36 is a vertical sectional view illustrating the construction of a rear portion of the outer lid.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

With reference to the attached drawings, embodiments of the present invention will hereinafter be described more specifically.

Fig. 1 is a perspective view illustrating the exterior of a drum-type laundry machine 1 according to one embodiment of the present invention.

The drum-type laundry machine 1 has an exterior shape defined, for example, by a generally cuboidal housing 2. The housing 2 has a top face 2A, an oblique face 2B, for example, inclined forwardly downward from the top face 2A, and an opening 4 provided in laterally middle portions of the top face 2A and the oblique face 2B and adapted to be covered and uncovered by an outer lid 3.

An operation display panel 5 for displaying information on operation settings (e.g., course settings) and operation states related to the operation of the drum-type laundry machine 1 is provided on the right side of the opening 4 on the oblique face 2B. Since the operation display panel 5 is provided on the oblique face 2B, the operation display panel 5 is oriented obliquely forwardly upward. Therefore, a user standing in front of the drum-type laundry machine 1 is able to cast his/her eyes obliquely downward on the operation display panel 5 perpendicularly to the surface of the operation display

panel 5. Thus, the user can easily view and operate the operation display panel 5.

A detergent dispenser 6 for introducing a detergent into the laundry machine with the outer lid 3 being closed, for example, is provided in a forwardly drawable manner on the left side of the opening 4 in the oblique face 2B.

Fig. 2 is a vertical sectional view of the drum-type laundry machine 1 taken along an anteroposterior vertical plane and seen from the right side. In Fig. 2, the outer lid 3 is not shown.

Referring to Fig. 2, a generally cylindrical outer tub 7 having closed opposite end faces is provided in the housing 2 with its axis extending laterally (generally horizontally). The outer tub 7 is supported, for example, at its front center bottom portion and laterally opposite rear bottom portions by dampers 8 (three dampers). In Fig. 2, only two dampers are seen.

A drum 10 for accommodating laundry therein is provided within the outer tub 7. The drum 10 is of a generally cylindrical shape with closed opposite end faces, and has an axis extending laterally (generally horizontally) coaxially with the axis of the outer tub 7.

Rotation shafts 11 are provided on the opposite end faces of the drum 10 as extending along the axis of the

drum 10. The respective rotation shafts 11 are attached to the outer tub 7 rotatably about the axis of the outer tub 7. A motor (not shown) such as of a DD (direct drive) type, for example, is coupled to the rotation shafts 11, so that the drum 10 connected to the rotation shafts 11 is rotated about the axis thereof by rotatively driving the motor.

A hose connection port 2C (see Fig. 1) for connection to a water supply hose extending to an external water supply equipment (a faucet or the like), for example, is provided on the top face 2A of the housing 2. In a laundry operation, tap water (hereinafter referred to simply as "water") supplied through the water supply hose is introduced into the laundry machine through the hose connection port 2C and supplied into the outer tub 7 through a water supply tube 15.

The drum 10 has a multiplicity of perforations (not shown) provided in the circumference thereof, so that the water supplied into the outer tub 7 flows into the drum 10 through the perforations. Baffles 10B (three baffles) for lifting the laundry in the drum 10 are provided circumferentially equiangularly (e.g., at every 120 degrees) on an inner peripheral surface of the drum 10 as projecting inward and extending laterally. In the washing process, the drum 10 is rotated, whereby the laundry

is lifted by the baffles 10B in the drum 10 and dropped from a certain height by gravity. By repeating this laundry lifting and dropping operation (tumbling operation), the laundry is slammed on the surface of the water contained in the outer tub 7 to perform a slam-washing operation.

Upon completion of the washing process, a rinsing process for removing a detergent from the laundry is performed, followed by a dehydrating process. In the dehydrating process, the drum 10 is rotated at a high speed (e.g., 300 to 1000 rpm), whereby water is squeezed out of the laundry by a centrifugal force. Then, the water squeezed out of the laundry is spun out toward the outer tub 7 through the perforations.

The drum 10 has an opening 22 provided in the circumference thereof for loading and unloading of the laundry. The outer tub 7 has an opening 23 provided in the circumference thereof in opposed relation to the opening 4 of the housing 2. The opening 23 of the outer tub 7 and the opening 22 of the drum 10 are adapted to be covered and uncovered by an inner lid 24 and a drum lid 25, respectively, which are pivotal outward (upward in Fig. 2). With the outer lid 3, the inner lid 24 and the drum lid 25 being all open, the laundry can be taken into and out of the drum 4.

The inner lid 24 is a plate member having, for example, a generally arcuate section. The inner lid 24 is pivotally attached along its rear edge to the outer tub 7. When the inner lid 24 is in a closed state, a distal edge of the inner lid 24 is engaged with the outer tub 7, so that the opening 23 is water-tightly covered.

To open the inner lid 24, the outer lid 3 should first be opened. With the outer lid 3 being open, a space is provided above the outer tub 7 to permit the inner lid 24 to be opened. In this state, the inner lid 24 is pivoted upward to uncover the opening 23 of the outer tub 7 by holding and lifting the distal edge of the inner lid 24.

The drum lid 25 includes, for example, a rear lid 25A and a front lid 25B. The rear lid 25A is pivotally attached along its rear edge to the circumference of the drum 10. On the other hand, the front lid 25B is pivotally attached along its front edge to the circumference of the drum 10. The rear edge of the rear lid 25A and the front edge of the front lid 25B are coupled to each other, for example, by a bar-shaped coupling member 26. When one of the rear lid 25A and the front lid 25B is pivoted, the other lid is pivoted in association with the one lid. Further, the rear lid 25A and the front lid 25B are biased in a lid opening direction (upward), for example, by biasing members (not shown) such as springs. The coupling member

26 is covered, for example, with a cover 27.

The front lid 25B has a claw 25C provided on its rear edge as projecting therefrom, and the rear lid 25A has an engagement recess 25D provided on its front edge in association with the claw 25C of the front lid 25B. With this arrangement, when the rear lid 25A and the front lid 25B are closed, the claw 25C is engaged with the engagement recess 25D, whereby the rear lid 25A and the front lid 25B are kept in a closed state.

To open the drum lid 25, a space should be provided above the drum 10 for opening the drum lid 25 by opening the outer lid 3 and the inner lid 24. In this state, the front lid 25B of the drum lid 25 is pressed down to disengage the claw 25C from the engagement recess 25D.

The rear lid 25A and the front lid 25B disengaged from each other are opened into a state as shown in Fig. 2 by biasing forces applied thereto by the biasing members, whereby the opening 22 of the drum 10 is widely opened. In this embodiment, the front lid 25B of the drum lid 25 is pressed down in association with the inner lid 24 being opened. Thus, the drum lid 25 is opened simultaneously with the inner lid 24 being opened.

When the drum lid 25 is to be closed, the rear lid 25A is merely pivoted downward, whereby the front lid 25B coupled to the rear lid 25A via the coupling member 26

is pivoted downward together with the rear lid 25A. Then, the claw 25C is engaged with the engagement recess 25D.

Figs. 3 and 4 are vertical sectional views of an outer lid 31 taken along an anteroposterior vertical plane and seen from the right side for explaining the construction of the outer lid 31 according to the first embodiment. Fig. 3 illustrates the outer lid 31 in a closed state, and Fig. 4 illustrates the outer lid 31 in an open state.

Referring to Figs. 3 and 4, the outer lid 31 according to this embodiment has a structure like a so-called bath tub lid, which includes a plurality of bar members 31A each extending laterally and connected to one another in parallel relation by a flexible member.

The outer lid 31 is slidable with its right and left side edges being fitted along side edges of the opening 4 of the housing 2. With this arrangement, the outer lid 31 is bendable between the respective bar members 31A. Therefore, the outer lid 31 is curved along the side edges of the opening 4 to cover the opening 4.

Guide members 31D are provided on the right and left side edges of the opening 4 as extending anteroposteriorly. When the outer lid 31 is slid along the side edges of the opening 4, right and left side edge portions of an upper surface of the outer lid 31 are fitted along lower surfaces of the guide members 31. Thus, the outer lid 31 is pressed

by the guide members 31D so as to be prevented from being raised from the side edges of the opening 4.

Where the opening 4 is covered from its rear edge to its front edge with the outer lid 31 as shown in Fig. 3, a force is applied to the outer lid 31 in a lid closing direction by gravity acting on the outer lid 31. In the state shown in Fig. 3, a projection 31B provided on the rear edge of the outer lid 31 abuts against a stopper 2D of the housing 2 to prevent the outer lid 31 from further sliding forward. With this arrangement, when the outer lid 31 is closed to the state as shown in Fig. 3, the outer lid 31 is kept in the closed state.

When the outer lid 31 is slid rearward from the state shown in Fig. 3 along the side edges of the opening 4 by holding a handle 31C provided on the front edge of the outer lid 31, the outer lid 31 is correspondingly retracted into the housing 2 from the rear side thereof. At this time, the outer lid 31 is accommodated in a rear portion of the housing 2 in a vertically suspended state. Alternatively, the outer lid 31 may be wound into a roll when being accommodated in the housing 2.

When the outer lid 31 is opened to a predetermined position, the direction of the force applied to the outer lid 31 by the gravity acting on the outer lid 31 is switched to a lid opening direction. Therefore, after the user

opens the outer lid 31 to the predetermined position, the outer lid 31 is automatically opened, so that the opening 4 of the housing 2 is uncovered as shown in Fig. 4. At this time, the handle 31C of the outer lid 31 abuts against the rear edge of the opening 4 to prevent the outer lid 31 from further sliding rearward. With this arrangement, when the outer lid 31 is opened to a state as shown in Fig. 4, the outer lid 31 is kept in the open state.

When the outer lid 31 is to be closed, the user holds the handle 31C to slide the outer lid 31 forward to the predetermined position. Then, the direction of the force applied to the outer lid 31 by the gravity acting on the outer lid 31 is switched to the lid closing direction, whereby the outer lid 31 is thereafter automatically closed.

In this embodiment, the direction of the force applied to the outer lid 31 by the gravity acting on the outer lid 31 is switched at the predetermined position. Therefore, when the outer lid 31 is to be opened, the outer lid 31 is merely slid from the closed state to the predetermined position, whereby the outer lid 31 is thereafter automatically opened. When the outer lid 31 is to be closed, the outer lid 31 is merely slid from the open state to the predetermined position, whereby the outer lid 31 is thereafter automatically closed. Thus, the

outer lid 31 can easily be opened and closed.

When the outer lid 31 is in the open state, the outer lid 31 is accommodated within the housing 2. Therefore, there is no possibility that the outer lid 31 hits against a faucet projecting from a wall for supplying water into the drum-type laundry machine 1, even if the drum-type laundry machine 1 is installed with a rear face of the housing 2 thereof fitted along the wall.

According to this embodiment, the opening and closing of the outer lid 31 having the aforesaid construction can advantageously be achieved as described above.

Although the explanation has been given to the outer lid 31 constructed so that the force is applied to the outer lid 31 in the lid closing direction or in the lid opening direction by the gravity acting on the outer lid 31 in the aforesaid embodiment, biasing means (e.g., a spring) may be provided for applying a force to the outer lid 31.

Means (e.g., a claw or the like) for keeping the outer lid 31 in the closed state may additionally be provided where the force is constantly applied to the outer lid 31 in the lid opening direction. Alternatively, means (e.g., a claw or the like) for keeping the outer lid 31 in the open state may additionally be provided where the

force is constantly applied to the outer lid 31 in the lid closing direction.

The outer lid 31 may be adapted to be slid forward to uncover the opening 4. In this case, the outer lid 31 may be accommodated in a front portion of the housing 2.

The outer lid 31 is not necessarily required to have the structure like a bath tub lid. For example, a flexible sheet member may be employed as the outer lid 31, as long as it is bendable and slidable with its side edges being fitted along the side edges of the opening 4.

Further, the outer lid 31 is not necessarily required to be opened and closed anteroposteriorly, but may be adapted to be opened and closed laterally.

Figs. 5 and 6 are vertical sectional views of an outer lid 32 taken along an anteroposterior vertical plane and seen from the right side for explaining the construction of the outer lid 32 according to the second embodiment. Fig. 5 illustrates the outer lid 32 in a closed state, and Fig. 6 illustrates the outer lid 32 in an open state.

Referring to Figs. 5 and 6, the outer lid 32 according to this embodiment includes, for example, a front lid 321 covering a front portion of the opening 4, and a rear lid 322 covering a rear portion of the opening 4. The rear lid 322 is pivotally attached along its rear edge to the

top face 2A of the housing 2 via a pivot shaft 323 extending laterally. The front lid 321 is pivotally attached along its rear edge to a front edge of the rear lid 322 via a pivot shaft 324 extending laterally. With the outer lid 32 being in an open state, the front lid 321 and the rear lid 322 are folded to project upward from the top face 2A, whereby the opening 4 is uncovered (see Fig. 6).

A torsion coil spring 325 is fitted around the pivot shaft 323. One end of the torsion coil spring 325 is fixed to the top face of the housing 2, and the other end of the torsion coil spring 325 abuts against a lower surface of the rear lid 32. With the outer lid 32 being in a closed state as shown in Fig. 5, a biasing force is applied to the rear lid 322 in a lid lifting direction in which the rear lid 322 is lifted (i.e., in a lid opening direction in which the outer lid 32 is opened) by the action of the torsion coil spring 325. The torsion coil spring 325 may include a single torsion coil spring provided at the center or one end of the pivot shaft 323, or two or more torsion coil springs.

The front lid 321 has a claw 326 provided in the middle of a front edge thereof for keeping the outer lid 32 in the closed state in engagement with a front upper edge of the housing 2. The housing 2 has an engagement hole 327 provided in an upper edge portion of the front

face thereof in such relation as to be opposed to the claw 326 with the outer lid 32 being in the closed state. When the outer lid 32 is in the closed state, the claw 326 of the front lid 321 is engaged with the engagement hole 327 (see Fig. 5). With this arrangement, the outer lid 32 is kept in the closed state against the biasing force applied thereto by the torsion coil spring 325.

An operation member 328 which is to be pressed from the front side by the user is provided on the upper edge portion of the front face of the housing 2 in opposed relation to the engagement hole 327. The operation member 328 is attached pivotally with respect to the front face of the housing 2, and biased toward the front face of the housing 2 (clockwise) by a proper magnitude of force.

The operation member 328 has a projection 328A to be inserted through the engagement hole 327. With the outer lid 32 being in a closed state, the operation member 328 is pushed up counterclockwise against the clockwise biasing force by the claw 326 engaged with the engagement hole 327 (see Fig. 5). When the user presses the operation member 328, the projection 328A is inserted through the engagement hole 327 to press the claw 326, so that the claw 326 is retracted from the engagement hole 327. As described above, the outer lid 32 is biased in the lid opening direction, so that the outer lid 32 is automatically

folded to uncover the opening 4 as shown in Fig. 6 when the claw 326 is retracted from the engagement hole 327.

When the outer lid 32 is to be closed, the user holds a handle 321A provided on the front lid 321, and pulls the front lid 321 forward against the biasing force of the torsion coil spring 325 to engage the claw 326 of the front lid 321 with the engagement hole 327.

Since the outer lid 32 can be opened through a one-touch operation simply by pressing the operation member 328 in this embodiment, there is no need to slide the outer lid 32 for a long distance from the front edge to the rear edge of the opening 4 to open the outer lid 32. Therefore, the opening and closing of the outer lid 32 can easily (advantageously) be achieved.

A damper (e.g., an oil damper attached to the pivot shaft 323) may be provided for preventing the outer lid 32 (rear lid 322) from being impetuously opened. With this arrangement, the outer lid 32 is prevented from being impetuously opened to be damaged. Thus, the opening and closing of the outer lid 32 can more advantageously be achieved.

Figs. 7 to 9 are vertical sectional views of an outer lid 33 taken along an anteroposterior vertical plane and seen from the right side for explaining the construction of the outer lid 33 according to a third embodiment. Fig.

7 illustrates the outer lid 33 in a closed state, and Fig. 8 illustrates the outer lid 33 in a half-open state. Fig. 9 illustrates the outer lid 33 in a full-open state.

Referring to Figs. 7 to 9, the outer lid 33 according to this embodiment includes, for example, a front lid 331 covering the front portion of the opening 4, and a rear lid 332 covering the rear portion of the opening 4. The rear lid 332 is pivotally attached along its rear edge to the top face 2A of the housing 2 via a pivot shaft 333 extending laterally. The front lid 331 is pivotally attached along its rear edge to a front edge of the rear lid 332 via a pivot shaft 334 extending laterally. With the outer lid 33 being in an open state, the front lid 331 and the rear lid 332 are folded to project upward from the top face 2A, whereby the opening 4 is uncovered (see Fig. 9).

A rear portion of a side face of the front lid 331 is coupled to a front portion of a side face of the rear lid 332 by an elongate coupling member 335. An end of the coupling member 335 adjacent to the front lid 331 is pivotally attached to the side face of the front lid 331 via a pivot shaft 335A. On the other hand, the coupling member 335 has a projection 335B provided at an end thereof adjacent to the rear lid 332. The projection 335B extends through an elongate hole 332A formed along the side face

of the rear lid 332. The end of the coupling member 335 adjacent to the rear lid 332 is coupled to a middle portion of the side face of the rear lid 332 via a tensile coil spring 336. The arrangement including the coupling member 335 and the tensile coil spring 336 may be provided on either or both of the laterally opposite sides of the outer lid 33.

Where the outer lid 33 is in the closed state as shown in Fig. 7, the coupling member 335 extends laterally of the pivot shaft 334, and a biasing force applied to the front lid 331 via the coupling member 335 by the action of the tensile coil spring 336 acts toward the pivot shaft 334 as indicated by an arrow in Fig. 7. Therefore, with the outer lid 33 being in a closed state, the biasing force applied to the front lid 331 by the tensile coil spring 336 hardly acts in such a direction as to pivot the front lid 331, so that the outer lid 33 is kept in the closed state. At this time, the projection 335B of the coupling member 335 abuts against a front end of the elongate hole 332A.

When the user holds a handle 331A provided on the front lid 331 to slide the front lid 331 rearward from the state shown in Fig. 7 while lifting a rear portion of the front lid 331, the projection 335B of the coupling member 335 is slid rearward along the elongate hole 332A.

Thus, the coupling member 335 is shifted downward below the pivot shaft 334, so that the biasing force applied to the front lid 331 via the coupling member 335 by the action of the tensile coil spring 336 acts in such a direction as to pivot the front lid 331 downward as indicated by an arrow in Fig. 8 (in a lid opening direction).

Therefore, after the outer lid 33 is opened from the closed state shown in Fig. 7 to a predetermined position, the force acts on the outer lid 33 in the lid opening direction until the opening 4 of the housing 2 is uncovered as shown in Fig. 9. In the state shown in Fig. 9, the projection 335B of the coupling member 335 abuts against a rear end of the elongate hole 332A to prevent the outer lid 33 from being further opened. In this state, the biasing force applied to the outer lid 33 by the tensile coil spring 336 acts in the lid opening direction as indicated by an arrow in Fig. 9, so that the outer lid 33 is kept in this state (in the open state).

When the outer lid 33 is to be closed, the user holds the handle 331A provided on the front lid 331 and pulls the front lid 331 forward against the biasing force of the tensile coil spring 336 until the outer lid 331 is brought into the state shown in Fig. 7.

In this embodiment, when the outer lid 33 is to be opened, the outer lid 33 is opened from the closed state

to the predetermined position. Then, the biasing force applied by the tensile coil spring 336 acts on the outer lid 33 in the lid opening direction. If the magnitude of the biasing force applied by the tensile coil spring 336 is set greater, the outer lid 33 is adapted to be automatically opened after being opened to the predetermined position. If the magnitude of the biasing force applied by the tensile coil spring 336 is set smaller, the outer lid 33 can be opened with a smaller magnitude of forth after being opened to the predetermined position. Thus, the opening and closing of the outer lid 33 can easily be achieved.

With the outer lid 33 being open, the projection 335B of the coupling member 335 abuts against the rear end of the elongate hole 332A, so that the outer lid 33 is prevented from being further opened. Therefore, even if the drum-type laundry machine 1 is installed with the rear face of the housing 2 thereof fitted along a wall, the outer lid 33 is prevented from hitting against a faucet projecting from the wall for supplying water into the drum-type laundry machine 1 by properly adjusting the length of the elongate hole 332A.

With the aforesaid construction of the outer lid 33 according to this embodiment, the opening and closing of the outer lid 33 can more advantageously be achieved.

A damper (e.g., an oil damper attached to the pivot shaft 333) may be provided for preventing the outer lid 33 (rear lid 332) from being impetuously opened. With this arrangement, the outer lid 33 is prevented from being impetuously opened to be damaged. Thus, the opening and closing of the outer lid 33 can more advantageously be achieved.

In this embodiment, the explanation has been given to the construction where the biasing force applied to the outer lid 33 by the tensile coil spring 336 hardly acts in a front lid pivoting direction in which the front lid 331 is pivoted with the outer lid 33 being in a closed state. However, where the biasing force is constantly applied to the outer lid 33 in the lid opening direction, means (e.g., a claw or the like) for keeping the outer lid 33 in the closed state may additionally be provided.

Figs. 10 to 12 are vertical sectional views of an outer lid 34 taken along an anteroposterior vertical plane and seen from the right side for explaining the construction of the outer lid 34 according to a fourth embodiment. Fig. 10 illustrates the outer lid 34 in a closed state, Fig. 11 illustrates the outer lid 34 in a half-open state, and Fig. 12 illustrates the outer lid 34 in a full-open state.

Referring to Figs. 10 to 12, the outer lid 34 according to this embodiment includes, for example, a front

lid 341 covering the front portion of the opening 4, and a rear lid 342 covering the rear portion of the opening 4. The rear lid 342 is pivotally attached along its rear edge to the top face 2A of the housing 2 via a pivot shaft 343 extending laterally. The front lid 341 is pivotally attached along its rear edge to a front edge of the rear lid 342 via a pivot shaft 344 extending laterally. With the outer lid 34 being in an open state, the front lid 341 and the rear lid 342 are folded to project upward from the top face 2A, so that the opening 4 is uncovered (see Fig. 12).

Side plates 4A are provided along opposite side edges of the opening 4 as projecting inward (transversely of the opening 4). Front portions of the side plates 4A are curved downward (see Figs. 11 and 12).

A guide member 345 movable along the side plate 4A is pivotally attached to a front end portion of a side face of the front lid 341 via a pivot shaft 346. The guide member 345 is generally L-shaped, and includes a base 345A pivotally attached at one end thereof to the pivot shaft 346, and an abutment portion 345B extending from the other end of the base 345A perpendicularly to the length of the base 345A (laterally) to abut against a lower surface (an inner surface) of the side plate 4A. With this arrangement, the front edge of the front lid 341 is guided along the

side plate 4A (i.e., both the front edge and the rear edge of the outer lid 34 are engaged with the housing 2), so that the outer lid 34 is prevented from being twisted when the outer lid 34 is opened and closed. Therefore, the outer lid 34 can smoothly be opened and closed. Thus, the opening and closing of the outer lid 34 can more advantageously be achieved

A torsion coil spring 347 is fitted around the pivot shaft 346. One end of the torsion coil spring 347 abuts against a lower surface of the front lid 341, and the other end of the torsion coil spring 347 abuts against a rear surface of the base 345A of the guide member 345. By the action of the torsion coil spring 347, a biasing force is applied to the guide member 345 in such a direction as to pivot the guide member 345 forward (clockwise). The arrangement including the guide member 345 and the torsion coil spring 347 may be provided on either or both of the laterally opposite sides of the outer lid 34.

Where the outer lid 34 is in the closed state as shown in Fig. 10, the guide member 345 is located in a front end portion of the side plate 4A (in a downwardly curved portion of the side plate 4A). In this state, the guide member 345 is pivoted rearward (counterclockwise) against the biasing force of the torsion coil spring 347, so that the biasing force applied to the side plate 4A

via the guide member 345 (the abutment portion 345B) by the action of the torsion coil spring 347 acts in a front lid extending direction in which the front lid 341 extends as shown by an arrow in Fig. 10. Therefore, when the outer lid 34 is in the closed state, a counter force applied to the pivot shaft 346 by the biasing force of the torsion coil spring 347 acts in a direction opposite from the arrow direction, but hardly acts in a front lid pivoting direction in which the front lid 341 is pivoted. Thus, the outer lid 34 is kept in the closed state.

When the user holds a handle 341A provided on the front lid 341 to slide the front lid 341 rearward from the state shown in Fig. 10 while lifting a rear portion of the front lid 341, the guide member 345 is pivoted clockwise by the biasing force of the torsion coil spring 347, and the abutment portion 345B is moved upward along the side plate 4A. Then, the side plate 4A is held between the abutment portion 345B of the guide member 345 and a lower surface of a side edge portion of the front lid 341 (see Fig. 11). Thus, the front lid 341 which is liable to move forward (in a lid closing direction) by gravity can be arrested by friction forces developed between the lower surface of the side plate 4A and the abutment portion 345B and between the upper surface of the side plate 4A and the lower surface of the front lid 341. Therefore,

the outer lid 34 is prevented from being automatically closed by gravity to be damaged, even if the user lets her hand off from the handle 341A in the opening or closing of the outer lid 34.

When the outer lid 34 is further opened to fully uncover the opening 4 of the housing 2 as shown in Fig. 12, the abutment portion 345B of the guide member 345 abuts against the rear edge of the opening 4 to prevent the outer lid 34 from being furthermore opened.

When the outer lid 34 is to be closed, the user holds the handle 341A provided on the front lid 341 and pulls the front lid 341 forward until the outer lid 341 is brought into the state shown in Fig. 10.

In this embodiment, when the outer lid 34 is in the full-open state, the abutment portion 345B of the guide member 345 abuts against the rear edge of the opening 4 to prevent the outer lid 34 from being further opened. Therefore, even if the drum-type laundry machine 1 is installed with the rear face of the housing 2 thereof fitted along a wall, the outer lid 34 is prevented from hitting against a faucet projecting from the wall for supplying water into the drum-type laundry machine 1 by properly adjusting a position at which the outer lid 34 is full-open. Thus, the opening and closing of the outer lid 34 can more advantageously be achieved.

Biasing means (e.g., a spring or the like) may be provided for applying a force to the outer lid 34 in the lid opening direction. In this case, where the force is constantly applied to the outer lid 34 in the lid opening direction, means (e.g., a claw or the like) for keeping the outer lid 34 in the closed state may additionally be provided.

Figs. 13 to 14 are vertical sectional views of an outer lid 35 taken along an anteroposterior vertical plane and seen from the right side for explaining the construction of the outer lid 35 according to a fifth embodiment. Fig. 13 illustrates the outer lid 35 in a closed state, and Fig. 14 illustrates the outer lid 35 in an open state.

Referring to Figs. 13 to 14, the outer lid 35 according to this embodiment includes, for example, a front lid 351 covering the front portion of the opening 4, and a rear lid 352 covering the rear portion of the opening 4. More specifically, the front lid 351 covers a portion of the opening 4 formed in the oblique face 2B of the housing 2, and the rear lid 352 covers a portion of the opening 4 formed in the top face 2A of the housing 2. That is, a portion of the opening 4 forward of a boundary between the top face 2A and the oblique face 2B of the housing 2 is covered with the front lid 351, and a portion of the opening 4 rearward of the boundary is covered with the

rear lid 352. The front lid 351 and the rear lid 352 each comprise a plurality of bar members 351A, 352A each extending laterally and connected to one another in parallel relation by a flexible member. Similarly to the outer lid 31 according to the first embodiment, the outer lid 35 has a structure like a so-called bath tub lid.

The front lid 351 and the rear lid 352 are slidable with their right and left side edges being fitted along the side edges of the opening 4 of the housing 2. With the aforesaid construction, the outer lid 35 is bendable between the respective bar members 351A and 352B so as to be curved along the side edges of the opening 4 to cover the opening 4.

Guide members 353 are provided on the right and left side edges of the opening 4 as extending anteroposteriorly. When the front lid 351 and the rear lid 352 are slid along the side edges of the opening 4, the right and left side edge portions of upper surfaces of the front lid 351 and the rear lid 352 are fitted on lower surfaces of the guide members 353. Thus, the front lid 351 and the rear lid 352 are pressed by the guide members 353 so as to be prevented from being raised from the side edges of the opening 4.

An endless wire 354 extending from the front side to the rear side in the housing and a plurality of pulleys 355 on which the endless wire 354 is entrained are provided

in the housing 2. The wire 354 and the pulleys 355 constitute a coupling mechanism for associating the opening and closing of the front lid 351 with the opening and closing of the rear lid 352. A rear edge of the front lid 351 and a rear edge of the rear lid 352 are fixedly connected to the wire 354 by connectors 356.

Where the outer lid 35 covers the opening 4 from the rear edge to the front edge as shown in Fig. 13, a projection 352B provided on the rear edge of the rear lid 352 abuts against a stopper 2D of the housing 2 to prevent the rear lid 352 from further sliding forward. When the user holds a handle 351B provided on the rear edge of the front lid 351 to slide the front lid 351 forward from the state shown in Fig. 13 along the side edges of the opening 4, the rear lid 352 is retracted into the housing 2 from its rear side by the operation of the coupling mechanism (including the wire 354 and the pulleys 355) (see Fig. 14).

At this time, the rear lid 352 is accommodated in the rear portion of the housing 2 as being vertically suspended. On the other hand, the front lid 351 is vertically suspended on the front side along the front face of the housing 2. Alternatively, the front lid 351 and the rear lid 352 may each be wound into a roll when the outer lid 35 is opened. Further, the front lid 351

may be accommodated in the front portion of the housing 2.

When the outer lid 35 is to be closed, the user holds the handle 351B to slide the front lid 351 rearward. Thus, the rear lid 352 is slid forward in association with the front lid 351, whereby the opening 4 is covered as shown in Fig. 13.

In this embodiment, the opening 4 can be uncovered and covered simply by sliding the front lid 351 for a distance half the anteroposterior dimension of the opening 4. Thus, the opening and closing of the outer lid 35 can more easily be achieved.

Further, the rear lid 352 is accommodated in the housing 2 when the outer lid 35 is opened. Therefore, even if the drum-type laundry machine 1 is installed with the rear face of the housing 2 thereof fitted along a wall, there is no possibility that the outer lid 35 hits against a faucet projecting from the wall for supplying water into the drum-type laundry machine 1.

With the aforesaid construction of the outer lid 35 according to this embodiment, the opening and closing of the outer lid 35 can more advantageously be achieved.

Biasing means (e.g., a spring or the like) may be provided for applying a force to the outer lid 35 in a lid opening or closing direction. In this case, means

(e.g., a claw or the like) for keeping the outer lid 35 in the closed state may additionally be provided where the force is constantly applied to the outer lid 35 in the lid opening direction. Further, means (e.g., a claw or the like) for keeping the outer lid 35 in the open state may additionally be provided where the force is constantly applied to the outer lid 35 in the lid closing direction.

The handle 351B may be provided on a front edge of the rear lid 352 rather than on the rear edge of the front lid 351. Alternatively, handles 351B may be provided on both the rear edge of the front lid 351 and on the front edge of the rear lid 352. In this case, the outer lid 35 can conveniently be opened and closed by sliding either of the front lid 351 and the rear lid 352.

The front lid 351 and the rear lid 352 are not necessarily required to have the structure like a bath tub lid. For example, flexible sheet members may be employed as the front lid 351 and the rear lid 352, as long as they are bendable and slidable with their side edges being fitted along the side edges of the opening 4.

The rear lid 352 may comprise two lids which are pivotally connected to each other and adapted to be folded as projecting upward from the top face 2A of the housing 2, rather than being constructed so as to be slid with

its side edges being fitted along the side edges of the opening 4.

The outer lid 35 is not necessarily required to be adapted to be opened and closed anteroposteriorly. For example, the outer lid 35 may be adapted to be opened and closed laterally.

Figs. 15 and 16 are plan views for explaining the construction of an outer lid 36 according to a sixth embodiment. Fig 15 illustrates the outer lid 36 in a closed state, and Fig. 16 illustrates the outer lid 36 in an open state.

Referring to Figs. 15 and 16, the outer lid 36 according to this embodiment includes, for example, a front lid 361 covering the front portion of the opening 4, and a rear lid 362 covering the rear portion of the opening 4. The rear lid 362 is pivotally attached along its left side edge to the top face 2A of the housing 2 via a pivot shaft 363 extending anteroposteriorly. The front lid 361 is pivotally attached along its rear edge to a front edge of the rear lid 362 via a pivot shaft 364 (see Fig. 16). Thus, the outer lid 36 is pivotal in a direction (lateral direction) intersecting a lid folding direction (anteroposterior direction) in which the front lid 361 and the rear lid 362 are folded.

The user holds a handle (not shown) provided on the

front lid 361 with the outer lid 36 being in a closed state as shown in Fig. 15, and pivots the front lid 361 rearward about the pivot shaft 364 with respect to the rear lid 362 while pivoting the front lid 361 and the rear lid 362 about the pivot shaft 363 upward to the left side. Thus, the front lid 361 and the rear lid 362 are folded as projecting upward from the top face 2A on the left side of the opening 4, whereby the opening 4 is uncovered (see Fig. 16).

Since the outer lid 36 can be folded on the left side of the opening 4 in this embodiment, the opening and closing of the outer lid 36 can more easily be achieved as compared with a case where the outer lid 36 is slid between the front edge and the rear edge of the opening 4 for a long distance for the opening and closing of the outer lid 36.

Even if the drum-type laundry machine 1 is installed with the rear face of the housing 2 thereof fitted along a wall, there is no possibility that the outer lid 36 hits against a faucet projecting from the wall for supplying water into the drum-type laundry machine 1, because the outer lid 36 is folded on the left side of the opening 4.

With the aforesaid construction of the outer lid 36 according to this embodiment, the opening and closing

of the outer lid 36 can more advantageously be achieved.

Biasing means (e.g., a spring or the like) may be provided for applying a force to the rear lid 362 in a lid opening direction. In this case, where the force is constantly applied to the rear lid 362 in the lid opening direction, means (e.g., a claw or the like) for keeping the outer lid 36 in the closed state may additionally be provided.

The front lid 361 may be adapted to be folded on the left side of the rear lid 362, rather than on the right side of the rear lid 362.

Further, the outer lid 36 may be constructed so that the front lid 361 and the rear lid 362 are folded on the right side of the opening 4 or on the diagonally rear side of the opening 4, rather than on the left side of the opening 4.

The outer lid 36 may comprise three or more lids rather than the two lids (the front lid 361 and the rear lid 362).

Figs. 17 and 18 are vertical sectional views of an outer lid 37 taken along an anteroposterior vertical plane and seen from the right side for explaining the construction of the outer lid 37 according to a seventh embodiment. Fig. 17 illustrates the inner lid 24 and the outer lid 37 in a closed state, and Fig. 18 illustrates the inner

lid 24 and the outer lid 37 in an open state.

Referring to Figs. 17 and 18, the outer lid 37 according to this embodiment includes, for example, a front lid 371 covering a front edge portion of the opening 4, and a rear lid 372 covering a portion of the opening 4 rearward of the front lid 371 (covering most of the opening 4). The front lid 371 has a relatively small anteroposterior dimension (depth), and the rear lid 372 has a relatively great anteroposterior dimension.

The rear lid 372 is pivotally attached along its rear edge to the top face 2A of the housing 2 via a pivot shaft 373 extending laterally. The front lid 371 is pivotally attached along its rear edge to a front edge of the rear lid 372 via a pivot shaft 374 extending laterally. With the outer lid 37 being in an open state, the rear lid 372 projects upward from the top face 2A, and the front lid 371 is folded as extending downward from the front edge of the rear lid 372 to the middle of the rear lid 372, whereby the opening 4 is uncovered (see Fig. 18). In this state, the gravity center of the outer lid 37 is shifted rearward, as compared with the conventional case where the front lid is folded as being opposed to the entire forward surface of the rear lid. Therefore, the outer lid 37 can properly be held in a folded state, even if the pivot angle (rearward inclination angle) of the rear

lid 372 is smaller.

A rear portion of a side face of the rear lid 372 is connected to a side plate 2E of the housing 2 by an elongate coupling member 375. An end of the coupling member 375 adjacent to the rear lid 372 is pivotally attached to the side face of the rear lid 372 via a pivot shaft 375A. On the other hand, the coupling member 375 has a projection 375B provided on an end thereof adjacent to the side plate 2E. The projection 375B is inserted through an elongate hole 375C formed in the side plate 2E of the housing 2. The arrangement including the coupling member 375 may be provided on either or both of the opposite side faces of the outer lid 37.

Where the outer lid 37 is in a closed state as shown in Fig. 17, the projection 375B of the coupling member 375 abuts against a front end of the elongate hole 375C. In this state, the user holds a handle 371A provided on the front lid 371, and slides the front lid 371 rearward while lifting the front lid 371. Then, the projection 375B of the coupling member 375 is slid rearward along the elongate hole 375C. Where the outer lid 37 is in an open state as shown in Fig. 18, the projection 375B of the coupling member 375 abuts against a rear end of the elongate hole 375C so as to prevent the outer lid 37 from being further opened.

When the outer lid 37 is to be closed, the user holds the handle 371A provided on the front lid 371, and pulls the front lid 371 forward to the state shown in Fig. 17.

In this embodiment, the front lid 371 is relatively smaller than the rear lid 372. When the inner lid 24 is to be opened after the outer lid 37 is opened as shown in Fig. 18, the inner lid 24 is opposed to the forward side of the rear lid 372, and the front lid 371 is located above the inner lid 24. That is, when the inner lid 24 is opened with the outer lid 37 being open in a folded state, the front edge (upper edge) of the inner lid 24 is not overlapped with the folded front lid 371. Thus, even if the rearward pivot angle of the rear lid 372 is smaller, the inner lid 24 can sufficiently be opened, as compared with a case where the inner lid 24 is opposed to the forward side of the folded front lid 372. Therefore, even if the drum-type laundry machine 1 is installed with the rear face of the housing 2 thereof fitted along a wall, the outer lid 37 is prevented from hitting against a faucet projecting from the wall for supplying water into the drum-type laundry machine 1. Thus, the opening and closing of the outer lid 37 can more advantageously be achieved.

Biasing means (e.g., a spring or the like) may be provided for applying a force to the outer lid 37 in a

lid opening direction. In this case, where the force is constantly applied to the rear lid 362 in the lid opening direction, means (e.g., a claw or the like) for keeping the outer lid 37 in the closed state may additionally be provided.

The outer lid 37 may comprise three or more lids, rather than the two lids (the front lid 371 and the rear lid 372).

Fig. 19 is a perspective view illustrating the exterior of a drum-type laundry machine 100 according to an eighth embodiment of the present invention.

The drum-type laundry machine 100 has an exterior shape, for example, defined by a generally cuboidal housing 200. The housing 200 has an open top. A top cover 210 is provided on the housing 200 to cover the open top. The top cover 210 has an opening 4 formed in a laterally middle portion of a top face thereof as extending from a front edge to a rear edge thereof, and the opening 4 is covered and uncovered by an outer lid 38. The outer lid 38 is anteroposteriorly slidable with its right and left side edges being fitted along right and left side edges of the opening 4 of the top cover 210.

A resin handle 38A to be held by a user when the outer lid 38 is slid is attached to a front edge of the outer lid 38. The handle 38A has an elongate shape having

a lateral dimension which is generally equal to the lateral dimension (width) of the outer lid 38. The handle 38A includes a handle projection 38B to be held by the user.

A rear cover 220 extending laterally is provided over a rear corner portion of the top cover 210. With the state where the rear cover 220 is attached to the top cover 210, the top face of the rear cover 220 and the top face of the top cover 210 are flush with each other. A tap water inlet port 2F for introducing tap water into the drum-type laundry machine 100 from an external water supply equipment (e.g., a faucet or the like) is provided in a left portion of the top face of the rear cover 220. Further, a bath water inlet port 2G for introducing bath water into the drum-type laundry machine 100 is provided in a right portion of the top face of the rear cover 220. The tap water introduced into the laundry machine through the tap water inlet port 2F or the bath water introduced into the laundry machine through the bath water inlet port 2G is used for a laundry operation.

As in the drum-type laundry machine 1 according to the first embodiment, an operation display panel 5 for displaying information on operation settings (e.g., course settings) and operation states related to the operation of the drum-type laundry machine 100 is provided on a right front portion of the top face of the top cover 210 (on

the right side of the opening 4). A detergent dispenser 6 for introducing a detergent into the laundry machine, for example, is provided in a forwardly drawable manner in a left front portion of the top face of the top cover 210 (on the left side of the opening 4).

Fig. 20 is an enlarged partial side view for explaining the construction of the outer lid 38.

The outer lid 38 has substantially the same construction as the outer lid 31 of the drum-type laundry machine 1 according to the first embodiment, and includes a plurality of bar members 381 each extending laterally and connected to one another in parallel relation. The bar members 381 each have a plurality of through-holes 381A (e.g., two through-holes) extending longitudinally thereof.

The bar members 381 each include a hook 381B provided along one longitudinal edge thereof as being curved downward. The bar members 381 each further include a hook receiver 381C provided along the other longitudinal edge thereof as being generally arcuately curved upward. The hook 381B has a distal edge portion having a generally round shape as laterally seen. The distal edge portion of the hook 381B is fitted in the arcuately curved hook receiver 381C, whereby the adjacent bar members 381 are connected to one another. The hook 381B and the hook

receiver 381C are pivotally engaged with each other. Thus, the adjacent bar members 381 are pivotal with respect with each other. With this arrangement, the outer lid 38 has a structure like a so-called bath tub lid, and is bendable between the respective bar members 381.

With the outer lid 38 being slightly bent between two adjacent bar members 381 thereof, the hook 381B is more liable to be disengaged from the hook receiver 381C when the hook 381B is pressed toward the connected bar member 381 (in an arrow direction A in Fig. 20) than when the hook receiver 381C is pressed toward the connected bar member 381 (in an arrow direction B in Fig. 20). Therefore, the outer lid 38 is adapted to be opened in the arrow direction B which makes the disconnection more difficult. As will be described later, the outer lid 38 is slid rearward and then downward. Even if the outer lid 38 is not smoothly slid at a bent portion thereof at which the sliding direction is changed, the hook 381B of the outer lid 38 is prevented from being disengaged from the hook receiver 381C, because the outer lid 38 is opened in the direction which makes the disconnection more difficult. A silicone oil (a lubricant) is applied to a connection between the hook 381B and the hook receiver 381C for ensuring smooth movement of the outer lid 38.

In this embodiment, upper surfaces of the plurality

of bar members 381 connected to one another (a main body of the outer lid 38) are covered with a flexible outer lid sheet 382. The outer lid sheet 382 has a thickness, for example, of about 0.5mm. As the outer lid 38 is bent between the respective bar members 381, the outer lid sheet 382 is curved. The outer lid sheet 382 prevents intrusion of dust and the like in recesses 381D defined on connections between the respective bar members 381. Further, the outer lid 38 with its upper surface covered with the outer lid sheet 382 has an improved appearance, as compared with such that the plural bar members thereof connected to one another are exposed like a bath tub lid. Further, the design of the drum-type laundry machine 100 can be improved by drawing a pattern or the like on the upper surface of the outer lid sheet 382. However, the outer lid 38 is not necessarily required to have the outer lid sheet 382.

Fig. 21 is a vertical sectional view of the drum-type laundry machine 100 taken along an anteroposterior vertical plane and seen from the right side. In Fig. 21, the outer lid 38 is not shown. The drum-type laundry machine 100 according to this embodiment has substantially the same internal construction as the drum-type laundry machine 1 according to the first embodiment (see Fig. 2). Therefore, components having the same construction as those of the drum-type laundry machine 1 according to the

first embodiment are denoted by the same reference characters in Fig. 21, and no explanation will be given thereto.

The top face of the top cover 210 of the drum-type laundry machine 100 is, for example, curved forwardly upward from right and left portions of its rear edge (defining the rear edge of the opening 4) and then inclined downward to its front edge. That is, right and left portions of the top face of the top cover 210 located on the laterally opposite sides of the opening 4 each include an oblique face 212 inclined forwardly downward, and an oblique face 211 extending continuously rearward from the oblique face 212 and inclined rearwardly downward. The top face of the top cover 210 is curved as having the greatest height at a rearward position thereof. The respective oblique faces 211 and 212 are convexly curved.

Edges of the oblique faces 211 and 212 of the top cover 210 adjacent to the opening 4 serve as receiving portions 213 which respectively receive the right and left side edges of the lower surface of the outer lid 38 (lower surfaces of the plural bar members 381) for sliding the outer lid 38 anteroposteriorly along the opening 4. Guide members 230 are attached to the top cover 210 as being opposed to and spaced a predetermined distance (generally equal to the thickness of the outer lid 38) from the

receiving portions 213. The guide members 230 prevent the right and left side edges of the upper surface of the outer lid 38 from being raised from the side edges of the opening 4.

A rear edge portion of the top face of the top cover 210 (rearward of the rear edge of the opening 4) is slightly inclined rearwardly downward, and smoothly curved downward to define a curved face 214. The curved face 214 functions to receive the lower surface of the outer lid 38 slid rearward from the opening 4 and vertically guide the outer lid 38 into a rear portion of the housing 200. In this embodiment, the oblique faces 211 inclined rearwardly downward are provided forwardly of the curved face 214, so that the outer lid 38 can be slid rearward from the opening 4 obliquely along the oblique faces 211 toward the curved face 214. Thus, the curved face 214 has a greater curvature radius, making it possible to more smoothly guide the outer lid 38 downward along the curved face 214.

The rear cover 220 is provided above the top cover 210 in opposed relation to the curved face 214 of the top cover 210. The rear cover 220 has guide surfaces 221 defined on right and left portions of a lower surface thereof as being opposed to and spaced a predetermined distance (generally equal to the thickness of the outer lid 38) from the curved face 214 and extending continuously

to lower surfaces of the guide members 230. As the outer lid 38 is slid rearward along the side edges of the opening 4, the outer lid 38 passes through a space 222 defined between the curved face 214 and the guide surfaces 221 thereby to be introduced into the housing 200 from the rear side thereof.

The curved face 214 is curved to extend vertically to a level higher than the outer tub 7. That is, the right and left side edges of the outer lid 38 are not guided below the curved face 214, so that the outer lid 38 is retracted into the rear portion of the housing 200 in a vertically suspended state. With this simple arrangement, the outer lid 38 can be accommodated in a vertically elongated narrow space defined behind the outer tub 7. Further, there is no need to provide rails (guide members) behind the outer tub 7 for guiding the right and left side edges of the outer lid 38. Hence, there is no possibility that, when the outer tub 7 is vibrated during operation thereof, the outer tub 7 collides against the rails to damage the rails.

A projection 71 having a vertically extending guide surface 71A is provided on an upper rear portion of the outer circumference of the outer tub 7. The guide surface 71A of the projection 71 smoothly extends along a downward extension line extending from the curved face 214.

Therefore, the outer lid 38 slid vertically into the rear portion of the housing 200 is smoothly moved downward with a surface thereof adjacent to the outer tub 7 being fitted along the guide surface 71A. Thus, the opening and closing of the outer lid 38 can more advantageously be achieved.

In general, many components (e.g., ribs and the like) are provided on the outer circumference of the outer tub 7. Where the edge (rear edge) of the outer lid 38 slid vertically into the rear portion of the housing 200 interferes with the outer circumference of the outer tub 7, the edge of the outer lid 38 is caught by the components of the outer tub 7. Hence, there is a possibility that the outer lid 38 cannot properly be accommodated in the rear portion of the housing 200. In this embodiment, however, the edge of the outer lid 38 is prevented from interfering with the outer tub 7 by sliding the outer lid 38 vertically into the rear portion of the housing 200 while guiding the surface of the outer lid 38 adjacent to the outer tub 7 by the guide surface 71A projecting rearward of the components provided on the outer circumference of the outer tub 7. Thus, the outer lid 38 can assuredly be accommodated in the rear portion of the housing 200 (behind the outer tub 7), so that the opening of the outer lid 38 can more advantageously be achieved. However, the guide surface 71A is not necessarily required

to be provided.

With the opening 4 being covered from its rear edge to its front edge with the outer lid 38, a force is applied to the outer lid 38 in a lid closing direction by gravity acting on the outer lid 38, so that the outer lid 38 is kept in a closed state. When the outer lid 38 is opened to a predetermined position, the direction of the force applied to the outer lid 38 by the gravity acting on the outer lid 38 is switched to a lid opening direction, so that the outer lid 38 is thereafter automatically opened. This feature is the same as in the case of the outer lid 31 of the drum-type laundry machine 1 according to the first embodiment. When the outer lid 38 is to be closed, the outer lid 38 is closed to the predetermined position, and the direction of the force applied to the outer lid 38 by the gravity acting on the outer lid 38 is switched to the lid closing direction, so that the outer lid 38 is thereafter automatically closed.

In this embodiment, the direction of the force applied to the outer lid 38 by the gravity acting on the outer lid 38 is switched at the predetermined position. Therefore, when the outer lid 38 is to be opened, the outer lid 38 is merely opened from the closed state to the predetermined position, whereby the outer lid 38 is thereafter automatically opened. When the outer lid 38

is to be closed, the outer lid 38 is merely closed from the open state to the predetermined position, whereby the outer lid 38 is thereafter automatically closed. Thus, the opening and closing of the outer lid 38 can more easily be achieved.

Further, the outer lid 38 is accommodated within the housing 200 when the outer lid 38 is opened. Therefore, even if the drum-type laundry machine 100 is installed with a rear face of the housing 200 thereof fitted along a wall, there is no possibility that the outer lid 38 hits against a faucet projecting from the wall for supplying water into the drum-type laundry machine 100.

Figs. 22 and 23 are sectional views for explaining an arrangement for attaching the outer lid 38. Fig. 22 illustrates a section of the outer lid 38 laterally taken along the bar member 381 and seen from the front side, and Fig. 23 illustrates a section of the outer lid 38 laterally taken along the handle 38A and seen from the front side. The outer lid 38 is attached by substantially the same arrangements on the right side and on the left side. Therefore, an explanation will be given only to the arrangement on the left side but not to the arrangement on the right side with reference to Figs. 22 and 23.

Referring to Figs. 22 and 23, the guide member 230 is anteroposteriorly elongated, and has an insert 231

provided on an edge thereof opposite from the opening 4 as projecting downward. An insertion recess 215 conformable to the insert 231 of the guide member 230 is provided in the upper surface of the top cover 210 as extending anteroposteriorly. With the insert 231 being fitted in the insertion recess 215, the guide member 230 is attached to the upper surface of the top cover 210 as extending anteroposteriorly (see Fig. 21).

The guide member 230 has a rib 232 provided on an edge thereof adjacent to the opening 4 as projecting downward. The upper surface of the upper cover 210 is formed with a step 216 having a lower level in the vicinity of the insertion recess 215 on the side of the opening 4, and a rib 217 is provided on a side edge of the step 216 adjacent to the opening 4 as projecting upward. The rib 217 has an upper end face which serves as a receiving portion 213 for guiding the left and right side edges of the lower surface of the outer lid 38 received thereon. A space defined by the step 216 of the top cover 210, the guide member 230 and the ribs 217 and 232 respectively provided on the side edges of the step 216 and the guide member 230 adjacent to the opening 4 serves as a guide recess 213A for guiding the side edge of the outer lid 38 received therein.

Referring to Fig. 22, insert members 383 are fitted

in through-holes 381A of predetermined ones of the plural bar members 381. The insert members 383 each include, for example, an insert portion 383A fitted in the through-hole 381A, an upper projection 383B projecting upward from an end of the insert portion 383A opposite from an insert member insertion direction, and a lower projection 383C projecting downward from the end of the insert portion 383A opposite from the insert member insertion direction. The insert member 383 is attached to the bar member 381 with its insert portion 383A fitted in the through-hole 381A and with its upper and lower projections 383B, 383C in abutment against an end face of the bar member 381.

With the side edge of the outer lid 38 being received in the guide recess 213A, side edges of lower surfaces of the respective bar members 381 are supported from the lower side by the rib 217 of the top cover 210, and the upper and lower projections 383B, 383C of the insert members 383 are fitted in the guide recess 213A. In this state, even if an attempt is made to displace the outer lid 38 away from the guide recess 213A in the opposite side, the lower and upper projections 383C and 383B are caught by the rib 217 of the top cover 210 and by the rib 232 of the guide member 230, respectively.

Referring to Fig. 23, a step 38C having a lower level

is provided on a side edge of an upper surface of the handle 38A, and an upper portion of a side plate 38D of the handle 38A projects upward from the step 38C. With the side edge of the outer lid 38 being received in the guide recess 213A, the side plate 38D of the handle 38A is fitted in the guide recess 213A, and a lower edge of the side plate 38D is supported by the step 216 of the top cover 210. In this state, the rib 232 of the guide member 230 is located in closely opposed relation to the step 38C of the handle 38A. Even if an attempt is made to displace the outer lid 38 away from the guide recess 213A in the opposite side, the upper portion of the side plate 38D of the handle 38A (projecting upward from the step 38C) is caught by the rib 232 of the guide member 230, and a lower portion of the side plate 38D is caught by the rib 217 of the top cover 210.

With the aforesaid arrangement, even if a force is applied to the outer lid 38 in a direction (e.g., a lateral direction) intersecting an anteroposterior direction when the user opens or closes the outer lid 38, the upper projections 383B and the lower projections 383C of the insert members 383 and the side plates 38D of the handle 38A are caught by the ribs 232 of the guide members 230 and the ribs 217 of the top cover 210. Hence, there is no possibility that the side edges of the outer lid 38

are disengaged from the guide recesses 213A. Therefore, the opening and closing of the outer lid 38 can more advantageously be achieved.

Fig. 24 is a plan view of the outer lid 38. The plurality of bar members 381 include bar members with their through-holes 381A fitted with the insert members 383, and bar members with their through-holes 381A fitted with no insert member 383. In this embodiment, the bar members 381 with their right and left ends fitted with the insert members 383 are each held between a plurality of bar members 381 with their right and left ends fitted with no insert member 383, and five sets of such bar members are anteroposteriorly equidistantly arranged.

The outer lid sheet 382 has a lateral dimension which is greater than the length of the bar members, so that right and left side edge portions of the outer lid sheet 382 project laterally from the bar members 381. The outer lid sheet 382 is attached to the bar members 381 with its lower surface in contact with the upper surfaces of the bar members 381. Therefore, the side edge portions of the outer lid sheet 382 need to have through-holes 382A formed in opposed relation to the bar members 381 fitted with the insert members 383 for receiving therein the upper projections 383B of the insert members 383 projecting above the upper surfaces of the bar members 381.

In this embodiment, the outer lid sheet 382 is formed with the through-holes 382A in association with the upper projections 383B of the insert members 383 fitted in the bar members 381 for receiving the upper projections 383B inserted therethrough. The through-holes 382A are anteroposteriorly elongated and each have a greater length than the upper projections 383B of the insert members 383.

The arrangement of the bar members 383 is not limited to the aforesaid arrangement in which the bar members 381 with their right and left edges fitted with the insert members 383 are each held between the plurality of bar members 381 with their right and left edges fitted with no insert member 383 and the plural sets of such bar members 383 are anteroposteriorly equidistantly arranged. Alternatively, the insert members 383 may be fitted in alternate bar members 381 or in plural consecutive bar members 381.

A plurality of fixture holes (e.g., three fixture holes) 382B are provided laterally in juxtaposition in a rear edge portion of the outer lid sheet 382. The fixture holes 382B are anteroposteriorly elongated. The outer lid sheet 382 is attached to the main body of the outer lid 38 by inserting stems 384A of fixtures 384 (e.g., screws) into the fixture holes 382B from the upper side. Thus, the rear edge portion of the outer lid sheet 382

is pressed by lower surfaces of heads 384B of the fixtures 384 so as to be prevented from being raised from the upper surface of the main body of the outer lid 38.

When the outer lid 38 is bent between the respective bar members 381, the outer lid sheet 382 is correspondingly curved, and the fixtures 384 are anteroposteriorly displaced relative to the fixture holes 382B of the outer lid sheet 382 and the main body of the outer lid 38. In this embodiment, the through-holes 382A are anteroposteriorly elongated as having a greater length than the upper projections 383B of the insert members 383, and the fixture holes 382B are anteroposteriorly elongated. Thus, the outer lid sheet 382 is attached to the main body of the outer lid 38 with a certain anteroposterior slack. Where the outer lid 38 is bent, the stems 384A of the fixtures 384 are anteroposteriorly slid along the fixture holes 382B. Therefore, the outer lid sheet 382 is prevented from being raised from the upper surface of the main body of the outer lid 38 by warpage thereof which may otherwise occur due to the displacement of the fixture holes 382B relative to the fixtures 384.

Fig. 25 is an enlarged partial vertical sectional view illustrating the surroundings of the rear cover 220 of the drum-type laundry machine 100, the sectional view being taken along an anteroposterior vertical plane and

seen from the right side.

In this embodiment, a blade-shaped resilient member 223 is attached to a front edge of the rear cover 220 as projecting downward. The resilient member 223 has a lateral dimension which is generally equal to a distance between the right and left guide members 230 attached to the top cover 210. The resilient member 223 extends downward so that its lower edge is located below the lower surfaces of the guide members 230. Therefore, when the outer lid 38 is anteroposteriorly slid to cover and uncover the opening 4, the distal edge of the resilient member 223 is brought into sliding contact with the upper surface of the outer lid 38 (the outer lid sheet 382) thereby to be resiliently deformed.

With this arrangement, even if a relatively thin matter (such as a coin) is placed on the outer lid 38 (particularly, on a portion of the outer lid 38 inclined rearwardly downward in association with the oblique faces 211 of the top cover 210), the foreign matter such as the coin is prevented from sliding rearward on the outer lid 38 to intrude into the rear portion of the laundry machine through a gap between the upper surface of the outer lid 38 and the rear cover 220.

Fig. 26 is an enlarged partial vertical sectional view illustrating a variation of the arrangement for

preventing the intrusion of the foreign matter in the rear cover 220, the sectional view being taken along an anteroposterior vertical plane of the drum-type laundry machine 100 and seen from the right side.

In this variation, a linear projection 385 for receiving a foreign matter such as a coin sliding rearward on the outer lid 38 is provided along the rear edge of the upper surface of the outer lid 38 rather than on the front edge of the rear cover 220. The linear projection 385 is located in opposed relation to the front edge of the rear cover 220 as extending straight between the two guide members 230 when the outer lid 38 is in a closed state.

In this variation, even if a relatively thin matter (such as a coin) is placed on the outer lid 38 (particularly, on the portion of the outer lid 38 inclined rearwardly downward in association with the oblique faces 211 of the top cover 210) when the outer lid 38 is in a closed state, the coin or the like is prevented from sliding rearward on the outer lid 38 to intrude into the rear portion of the laundry machine through a gap between the upper surface of the outer lid 38 and the rear cover 220.

Fig. 27 is a plan view illustrating the drum-type laundry machine 100 with its rear cover 220 removed. In Fig. 27, a front portion of the drum-type laundry machine

100 is not shown.

In general, a water supply valve V for switching on and off the supply of the tap water into the laundry machine through the tap water inlet port 2F and a bath water pump P for pumping up the bath water into the laundry machine through the bath water inlet port 2G are disposed in a rear upper portion of the drum-type laundry machine. In this embodiment, however, the drum-type laundry machine is designed so that the outer lid 38 is slid rearward to be accommodated in the rear portion of the housing 200 to uncover the opening 4. Therefore, if the water supply valve V and the bath water pump P are disposed on the curved face 214 of the top cover 210, the water supply valve V and the bath water pump P interferes with the outer lid 38 which is adapted to be slid rearward. It is conceivable to provide the water supply valve V and the bath water pump P behind the curved face 214. In this case, however, it is necessary to provide a space for accommodating the water supply valve V and the bath water pump P behind the curved face 214, so that the depth of the drum-type laundry machine is increased.

In this embodiment, the water supply valve V is disposed on the left side of the curved face 214 of the top cover 210 (behind the left oblique face 211), and the bath water pump P is disposed on the right side of the

curved face 214 of the top cover 210 (behind the right oblique face 211). Thus, the water supply valve V and the bath water pump P are disposed away from a region where the outer lid 38 is slidable and, hence, prevented from interfering with the outer lid 38 which is slid rearward. Therefore, the opening and closing of the outer lid 38 can advantageously be achieved. Since the water supply valve V and the bath water pump P are disposed in free spaces behind the left and right oblique faces 211, there is no need to increase the size of the drum-type laundry machine 100 for accommodating the water supply valve V and the bath water pump P.

The tap water introduced into the laundry machine through the water supply valve V from the tap water inlet port 2F flows into the detergent dispenser 6 through a tap water supply tube H1 extending forward from the water supply valve V and, after being mixed with a detergent contained in the detergent dispenser 6, flows into the outer tub 7.

A pump-priming water inlet tube H2 for introducing the tap water into the bath water pump P from the tap water inlet port 2F is connected to the tap water supply tube H1. The bath water can properly be pumped up by driving the bath water pump P to introduce a predetermined amount of water (so-called pump-priming water) into the bath water

pump P through the pump-priming water inlet tube H2 and starting the pumping of the bath water through the bath water inlet port 2G. The pump-priming water inlet tube H2 is accommodated in an accommodation recess 214A defined above the curved face 214 of the top cover 210 so as not to interfere with the outer lid 38 which is slid on the curved face 214.

The bath water pumped up by the bath water pump P is supplied into the detergent dispenser 6 through a bath water supply tube H3. The bath water supply tube H3 is routed from the bath water pump P along the rear edge of the top cover 210 (behind the curved face 241) to the left edge of the top cover 210, and communicates with the detergent dispenser 6. Therefore, the bath water pumped up by the bath water pump P is supplied through the bath water supply tube H3 from the right side to the left side of the top cover 210, and then flows into the detergent dispenser 6.

The water supply valve V and the bath water pump P are not necessarily required to be disposed on the left side and the right side, respectively, of the curved face 214, but may be disposed on the right side and the left side, respectively, of the curved face 214.

Fig. 28 is a schematic diagram illustrating a mechanism for opening and closing the outer lid 38 according

to a first variation.

In this variation, the outer lid 38 is not manually opened and closed, but electrically opened and closed by an electric opening/closing mechanism 300 including a stepping motor M1. Therefore, the opening and closing of the outer lid 38 can easily be achieved as compared with a case where the outer lid 38 is manually opened and closed. The outer lid 38 has the same construction as in the eighth embodiment, and is bendable with its plural bar members 38 being pivotally connected to one another.

Gears G meshed with racks (not shown) provided on the right and left side edge portions of the lower surface of the outer lid 38 are respectively provided below the right and left side edges of the outer lid 38. The gears G are respectively rotatable about rotation shafts R. The stepping motor M1 is attached to one of the rotation shafts R (e.g., a right rotation shaft R). The stepping motor M1 is driven to be rotated at a predetermined angle per pulse on the basis of a periodic input pulse. Therefore, a preset number (preset pulse number) of input pulses are transmitted to the stepping motor M1, whereby the rotation shaft R and the gear G are rotated at a predetermined angle. Thus, the outer lid 38 can be slid for a predetermined distance.

In this variation, the stepping motor M1 is

connected to a control section MC for controlling the operation of the drum-type laundry machine 100. The control section MC comprises, for example, a microprocessor and the like. The operation panel 5 is connected to the control section MC, and a signal is inputted to the control section MC on the basis of the operation of the operation panel 5.

When the outer lid 38 is to be opened, a lid opening button 52 on the operation panel 5 is pressed. Then, the control section MC, which receives a signal based on the button pressing, transmits a preset number of input pulses required for fully opening the outer lid 38 to the stepping motor M1, thereby rotating the stepping motor M1 in one direction (in a normal direction). Thus, the rotation shaft R and the gear G are rotated at a predetermined angle to slide the outer lid 38 for a distance required for completely uncovering the opening 4.

Where the inner lid 24 for covering and uncovering the opening 23 of the outer tub 7 and the drum lid 25 for covering and uncovering the opening 22 of the drum 10 are adapted to be simultaneously opened as previously described with reference to Fig. 2, the laundry can be taken into and out of the drum 10 simply by opening the outer lid 38 by the pressing of the lid opening button 52 and then opening the inner lid 24. Thus, the convenience

of the laundry machine is improved.

On the other hand, the outer lid 38 is adapted to be closed by pressing a start button 51 for starting the operation of the drum-type laundry machine 100. That is, when the start button 51 is pressed, the control section MC, which receives a signal based on the button pressing, transmits a preset number of input pulses required for fully closing the outer lid 38 (the same number of pulses as the preset pulse number required for opening the outer lid 38) to the stepping motor M1, thereby rotating the stepping motor M1 in the other direction (in a reverse direction). Thus, the rotation shaft R and the gear G are rotated at a predetermined angle to slide the outer lid 38 for a distance required for fully covering the opening 4. With this arrangement, after the laundry is loaded in the drum 10, the outer lid 38 is automatically closed and the operation is started simply by pressing the start button 51. Therefore, the convenience of the laundry machine is improved.

In this variation, an inner lid sensor 24A for detecting whether or not the inner lid 24 is closed is connected to the control section MC. The control section MC rotates the stepping motor M1 in the reverse direction to slide the outer lid 38 in the lid closing direction only when the closed state of the inner lid 24 is detected

on the basis of a signal from the inner lid sensor 24A and the start button 51 is pressed. With this arrangement, there is no possibility that, when the user forgets to close the inner lid 24, the outer lid 38 is closed with the inner lid 24 being opened. Thus, the outer lid 38 is prevented from being damaged in collision against the inner lid 24 in the open state.

The drum-type laundry machine 100 may be adapted to detect whether or not the drum lid 25 is closed, rather than whether or not the inner lid 24 is closed. In this case, the outer lid 38 may be adapted to be slid in the lid closing direction only when the closed state of the drum lid 25 is detected.

The construction of the outer lid opening/closing mechanism is not limited to the aforesaid construction in which only one of the rotation shafts R is provided with the stepping motor M1, but the rotation shafts R may both be provided with stepping motors M1. In this case, one of the stepping motors M1 may be driven to be rotated for opening the outer lid 38, and the other stepping motor M1 is driven to be rotated for closing the outer lid 38.

Fig. 29 is a schematic diagram illustrating a mechanism for opening and closing the outer lid 38 according to a second variation.

In this variation, the outer lid 38 is not manually

opened and closed, but electrically opened and closed by an electric opening/closing mechanism 400 including torque motors M2. Therefore, the opening and closing of the outer lid 38 can easily be achieved as compared with a case where the outer lid 38 is manually opened and closed. The outer lid 38 has the same construction as in the eighth embodiment, and is bendable with its plural bar members 381 being pivotally connected to one another.

As in the first variation, gears G meshed with racks (not shown) provided on the right and left side edge portions of the lower surface of the outer lid 38 are respectively provided below the right and left side edges of the outer lid 38. The gears G are respectively rotatable about rotation shafts R. The torque motors M2 are attached to the respective rotation shafts R.

In this variation, the torque motors M2 are connected to a control section MC for controlling the operation of the drum-type laundry machine 100. The control section MC comprises, for example, a microprocessor and the like. The operation panel 5 is connected to the control section MC, and a signal is inputted to the control section MC on the basis of the operation of the operation panel 5.

When the outer lid 38 is to be opened, a lid opening button 52 on the operation panel 5 is pressed. Then, the

control section MC, which receives a signal based on the button pressing, transmits a signal to one of the torque motors M2 for rotatively driving the one torque motors M2. Thus, the one torque motor M2 is driven to be rotated in such a direction as to open the outer lid 38. At this time, the other torque motor M2 is passively rotated by rotation of the gear G and the rotation shaft R due to the sliding of the outer lid 38.

A micro-switch MS, for example, is disposed at a position which is reached by the rear edge of the outer lid 38 when the outer lid 38 is in the full-open state (as indicated by a one-dot-and-dash line in Fig. 29). When the outer lid 38 is slid to the full-open state, the rear edge of the outer lid 38 abuts against an actuator MS1 of the micro-switch MS, and a detection signal generated on the basis of an offset of the actuator MS1 is transmitted to the control section MC from the micro-switch MS. On the basis of the detection signal from the micro-switch MS, the control section MC judges that the outer lid 38 is slid to the full-open state, and stops the rotation of one of the torque motor M2. Thus, the outer lid 38 is kept in the open state by dead load.

Where the inner lid 24 for covering and uncovering the opening 23 of the outer tub 7 and the drum lid 25 for covering and uncovering the opening 22 of the drum 10 are

adapted to be simultaneously opened as previously described with reference to Fig. 2, the laundry can be taken into and out of the drum 10 simply by opening the outer lid 38 by the pressing of the lid opening button 52 and then opening the inner lid 24. Thus, the convenience of the laundry machine is improved.

On the other hand, the outer lid 38 is adapted to be closed by pressing a start button 51 for starting the operation of the drum-type laundry machine 100. That is, when the start button 51 is pressed, the control section MC, which receives a signal based on the button pressing, transmits a signal to the other torque motor M2 for rotatively driving the other torque motor M2. Thus, the other torque motor M2 is driven to be rotated in such a direction as to close the outer lid 38. At this time, the one torque motor M2 is passively rotated by rotation of the gear G and the rotation shaft R due to the slide of the outer lid 38.

A lead switch LS, for example, is disposed at a position (i.e., adjacent to the front edge of the opening 4) which is reached by the front edge of the outer lid 38 when the outer lid 38 is in the fully closed state (as indicated by a solid line in Fig. 29). The lead switch LS is operative in such a manner that its contacts are brought into and out of contact with each other (on/off)

when a magnetic field generated by a magnet (not shown) attached to the front edge of the outer lid 38 in association with the lead switch LS is changed by the slide of the outer lid 38. When the outer lid 38 is slid to the fully closed state, the lead switch Ls is turned on, and a detection signal is transmitted to the control section MC from the lead switch LS.

In this variation, a lock device L for locking the outer lid 38 in the closed state is provided in the vicinity of the front edge of the opening 4. The lock device L has a pin L1 displaceable along an axis thereof. A lock projection 386 having a through-hole 386A is provided on the front edge of the outer lid 38. When the control section MC judges on the basis of the detection signal from the lead switch LS that the outer lid 38 is slid to the fully closed state, the control section MC displaces the pin L1 of the lock device L to insert the pin L1 into the through-hole 386A of the lock projection 386, whereby the outer lid 38 is locked in the closed state. Thereafter, the control section MC stops the rotation of the other torque motor M2.

With this arrangement, the outer lid 38 is automatically closed and locked by the lock device L, and then the operation of the laundry machine is started simply by pressing the start button 51 after the laundry is loaded

in the drum 10. Therefore, the convenience of the laundry machine is improved.

In this variation, an inner lid sensor 24A for detecting whether or not the inner lid 24 is closed is connected to the control section MC. The control section MC rotates the other torque motor M2 in a reverse direction to slide the outer lid 38 in the lid closing direction only when the closed state of the inner lid 24 is detected on the basis of a signal from the inner lid sensor 24A and the start button 51 is pressed. With this arrangement, there is no possibility that, when the user forgets to close the inner lid 24, the outer lid 38 is closed with the inner lid 24 being open. Thus, the outer lid 38 is prevented from being damaged in collision against the inner lid 24 in the open state.

The drum-type laundry machine 100 may be adapted to detect whether or not the drum lid 25 is closed, rather than whether or not the inner lid 24 is closed. In this case, the outer lid 38 may be adapted to be slid in the lid closing direction only when the closed state of the drum lid 25 is detected.

The construction of the outer lid opening/closing mechanism is not limited to the aforesaid construction in which the rotation shafts R are both provided with the torque motors M2, but only one of the rotation shafts R

may be provided with a torque motor M2. In this case, the torque motor M2 is driven to be rotated in one direction (in a normal direction) for opening the outer lid 38, and driven to be rotated in the other direction (in a reverse direction) for closing the outer lid 38.

In the first and second variations, the explanation has been given to the outer lid opening/closing mechanisms which are adapted to open and close the outer lid 38 by the rotation of the gears G meshed with the racks provided on the lower surface of the outer lid 38, but the construction of the outer lid opening/closing mechanism is not limited thereto. For example, the outer lid opening/closing mechanisms may be constructed so as to open and close the outer lid 38 by utilizing a friction force occurring between the lower surface of the outer lid 38 and the circumference of a roll provided in abutment against the lower surface of the outer lid 38. Alternatively, the outer lid opening/closing mechanisms may be constructed so as to open and close the outer lid 38 by winding and unwinding a wire connected to the outer lid 38 by a motor.

Further, the outer lid opening/closing mechanisms may be constructed so that, when the outer lid 38 is opened, the rotation speed of the motor is reduced immediately before the outer lid 38 is brought into the full-open state

and, when the outer lid 38 is closed, the rotation speed of the motor is reduced immediately before the outer lid 38 is brought into the fully closed state. In this case, the outer lid 38 is prevented from being impetuously opened and closed to be damaged.

Next, an explanation will be given to an outer lid opening/closing mechanism according to a ninth embodiment of the present invention. This outer lid opening/closing mechanism is a modification of the outer lid opening/closing mechanism of the drum-type laundry machine according to the eighth embodiment. In figures to be hereinafter referred to, components having the same construction as those of the drum-type laundry machine according to the eighth embodiment are denoted by the same reference characters as in the eighth embodiment, and no explanation will be given thereto.

In the drum-type laundry machine according to the ninth embodiment, slide assist members for reducing the sliding resistance of the outer lid 38 and facilitating the opening and closing of the outer lid 38 are provided on the opposite ends of the handle 38A.

Fig. 30 is a sectional view of the surroundings of the handle 38A taken along an anteroposterior vertical plane for explaining sled members as an example of the slide assist members. The sled members 500, which are

slidable on the receiving portions 213 of the top cover 210 as the outer lid 38 is slid, are respectively fixed to the opposite ends of the handle 38A, for example, by two screws 501. The sled members 500 are more slippery (i.e., have a smaller friction coefficient) than the handle 38A, and composed of a highly wear-resistant material such as a polyacetal resin or a nylon resin. The provision of the sled members 500 facilitates the opening and closing of the outer lid 38, and prevents the receiving portions 213 of the top cover 210 from being worn due to sliding contact with the handle 38A.

The sled members 500 each have an anteroposterior dimension which is greater than the anteroposterior dimension of the handle 38A. Even with gaps between upper edges of the sled members 500 and the lower surfaces of the guide members 230, the handle 38A is less liable to rattle. Thus, the outer lid 38 can smoothly be slid. Further, lower end faces 500A of the sled members 500 (in sliding contact with the receiving portions 213) are concavely curved to conform to the convexly curved surfaces of the receiving portions 213. The curvature radius of the sled members 500 is equal to the smallest curvature radius of the convexly curved surfaces of the receiving portions 213. Thus, the lower end faces 500A of the sled members 500 have the greatest possible areas in sliding

contact with the receiving portions 213.

Fig. 31 is a sectional view of the surroundings of the handle 38A taken along an anteroposterior vertical plane for explaining roller members as another example of the slide assist members. The roller members 502 are respectively attached to the opposite ends of the handle 38A. The roller members 502 each include a retention member 503 having roller shafts 503A provided front and rear portions thereof, and two rollers 504 attached rotatably about the roller shafts 503A so as to be rolled on the receiving portion 213 of the top cover 210 when the outer lid 38 is slid. The retention member 503 has an anteroposterior dimension which is greater than the anteroposterior dimension of the handle 38A.

Further another example of the slide assist members is spinning top members which are slidable on the receiving portions 213. Further, PE sheets (polyethylene sheets) as the slide assist members may be bonded onto the opposite side edge portions of the back surface of the outer lid 38 to be opposed to the receiving portions 213. With this arrangement, the outer lid 38 per se is more slippery, so that smoother sliding of the outer lid 38 can be ensured. In this case, a thicker adhesive layer or the like having a cushioning property may be provided between the PE sheet and the outer lid 38 for bonding the PE sheet. Thus, noises

occurring when the outer lid 38 is slid can be reduced.

Fig. 32 is a vertical sectional view illustrating a front portion of the top cover 210 with the outer lid 38 being in a closed state. Protuberances 505 (resistive members) are respectively provided on front end portions of the back surfaces of the guide members 230 opposed to the receiving portions 213 as being slightly raised downward. The protuberances 505 are brought into sliding contact with upper end faces 500B of the sled members 500 to provide resistances to the sled members 500 shortly before the handle 38A abuts against the front edge 4A of the opening 4 of the top cover 210, i.e., shortly before the outer lid 38 is fully closed. With this arrangement, even if the user impetuously closes the outer lid 38, the impetus of the outer lid 38 is reduced before the handle 38A hits against the front edge 4A of the opening 4, thereby preventing application of great impacts on the handle 38A and the opening front edge 4A. Further, the protuberances 505 abut against the upper end faces 500B of the sled members 500 when the outer lid 38 is in a fully closed state. This prevents the up and down movement of the sled members 500, so that trembling of the handle 38A is prevented which may otherwise occur due to vibrations during the dehydration process.

Though not shown, protuberances having

substantially the same function as the protuberances 505 provided on the front end portions of the guide members 230 are respectively provided on rear end portions of the back surfaces of the guide members 230. Thus, even if the user impetuously opens the outer lid, the impetus of the outer lid 38 is reduced before the handle 38A hits against the rear edge of the opening, thereby preventing application of great impacts on the handle 38A and the opening rear edge.

A PE sheet 506 (slidability improving member) is provided on a portion of the back surface of each of the guide members 230 opposed to the receiving portion 213 (between the frond end portion and the rear end portion) except areas where the aforesaid front and rear protuberances are provided. Thus, when the outer lid 38 is slid with the upper end faces 500B of the sled members 500 being in contact with the back surfaces of the guide members 230, the outer lid 38 is less liable to suffer from resistance. Therefore, the opening and closing of the outer lid 38 can more smoothly be achieved.

A silicone oil (lubricant) for improving the slidability is applied onto the receiving portions 213 of the top cover 210, the lower end faces 500A of the sled members 500, surfaces of the PE sheets 506 provided on the back surfaces of the guide members 230, and the portions

of the back surface of the outer lid 38 which are brought into sliding contact with the receiving portions 213 (or surfaces of the PE sheets in a case the PE sheets is bonded thereto). Thus, the opening and closing of the outer lid 38 can further more smoothly be achieved.

Fig. 33 is a sectional view of the surroundings of the handle 38A taken along an anteroposterior vertical plane for explaining a fixture arrangement for fixing the handle 38A to the outer lid 38. Fixture bosses 507 for fixing the outer lid 38 are provided on a portion of the back surface of the handle 38A rearward of the middle of the handle 38A as seen from the lateral side. The fixture bosses 507 are arranged in juxtaposition longitudinally (laterally) of the handle 38A. The headmost one of the bar members 381 of the outer lid 38 has fixture holes 508 formed therein in association with the fixture bosses. The fixture holes 508 each have an inner diameter which is slightly greater than the outer diameter of the fixture bosses 507. Further, the outer lid sheet 382 has fixture holes 509 overlapping with the fixture holes 508 in communication with the fixture holes 508. The fixture bosses 507 each have a height which is greater than the thickness of the bar member 381, and their distal end portions project from the lower surface of the bar member 381 when the fixture bosses 507 are inserted through the

fixture holes 508 and 509. In this state, screws 511 are respectively fixed to the fixture bosses 507 via washers 510, whereby the bar member 381, i.e., the outer lid 38, is fixed to the handle 38A. Since the washers 510 and heads of the screws 511 each have a diameter greater than the inner diameter of the fixture holes 508, the bar member 381 is not disengaged from the fixture bosses 507. In this fixture arrangement, gaps are defined between the washers 510 and the lower surface of the bar member 381, so that the lower surface of the bar member 381 is not pressed by the screws 511. That is, the bar member 381 is fixed so as to be vertically and horizontally movable within a predetermined range with respect to the handle 38A. Therefore, when the outer lid 38 is slid along the convexly curved receiving portions 213, a connection between the handle 38A and the outer lid 38 is bendable in conformity with the curvature of the convexly curved receiving portions 213. Thus, the opening and closing of the outer lid 38 can smoothly be achieved.

Ribs 512 are arranged in juxtaposition longitudinally of the handle 38A on a rear surface of a front wall of the handle 38A as projecting toward the headmost bar member. The ribs 512 are adapted to be brought into abutment against the hook 381B of the bar member 381 before rear edges of the fixture holes 508 are brought

into contact with rear portions of the fixture bosses 507 when the headmost bar member 381 is moved forward. Therefore, even if the outer lid 38 is impetuously closed to impetuously move the bar members 381 forward, there is no possibility that the rear edges of the fixture holes 508 are brought into contact with the rear portions of the fixture bosses 507 to apply great impacts onto the fixture bosses 507. Thus, the breakage of the fixture bosses 507 can be prevented.

Fig. 34 is a sectional view of the surroundings of the rear cover 220 for explaining, in detail, the construction of a rear portion of the top cover 210 covered with the rear cover 220. A reinforcement metal member 513 as a reinforcement component is attached to a back surface of a front portion of the rear cover 220 by screws 514. The reinforcement metal member 513 has a lateral dimension which is generally equal to the distance between the right and left guide members 230 attached to the top cover 210. Even if a relatively heavy matter such as a detergent container is placed on a front middle portion of the rear cover 220, the front middle portion of the rear cover 220 is less liable to be depressed, because the back surface of the front portion of the rear cover 220 is reinforced by the reinforcement metal member 513. Thus, a lid introduction port 220A through which the outer

lid 38 is introduced into the rear cover 220 is prevented from being narrowed, thereby ensuring smooth opening and closing of the outer lid 38.

A raise prevention member 515 for preventing the outer lid sheet 382 from being raised during the sliding of the outer lid 38 is provided below the reinforcement metal member 513 in contact with the outer lid sheet 382. The raise prevention member 515 is composed of a material (e.g., a felt sheet) which is softer than the outer lid sheet 382 so as not to damage the outer lid sheet 382. The raise prevention member 515 has a lateral dimension which is generally equal to the lateral dimension of the reinforcement metal member 513. The raise prevention member 515 prevents intrusion of foreign matter into the lid introduction port 220A. Therefore, the raise prevention member 515 also functions as a foreign matter intrusion preventing member.

If a distance between the curved face 214 of the top cover and the guide surfaces 221 of the rear cover 220 and a distance between the curved face and a guide portion 210A of the top cover (provided on the rear edge of the top cover and continuous to the guide surfaces) are too small, i.e., if the width of a slide path along the curved portion at which the slide direction of the outer lid 38 is changed is too small as compared with the

thickness of the outer lid 38, there is a possibility that a resistance developed on the outer lid 38 prevents smooth movement of the outer lid 38. Hence, the slide path along the curved portion needs to have a relatively great width, but this may unsettle the outer lid 38 on the curved portion, resulting in noises. Therefore, a resilient member is provided for biasing the outer lid 38 rearward immediately after the outer lid 38 is bent downward. More specifically, a leaf spring 516 is provided as the resilient member on the curved face 214. Further, a protective member 517 is provided on a front face of the guide member 210A. With this arrangement, even if the outer lid 38 is biased by the leaf spring 516 to heavily abut against the guide member 210A (which guides the front surface of the outer lid 38), there is no possibility that the outer lid sheet 382 is damaged and the outer lid 38 suffers from a sliding resistance. The protective member 517 is composed of a material which is softer and more slippery than the outer lid sheet 382, for example, a felt sheet. With this arrangement, even if the slid path along the curved portion has a greater width, the outer lid 38 is less liable to be unsettled, so that the noises can be prevented. Thus, the smooth opening and closing of the outer lid 38 can be ensured.

A part of an air passage member 518 defining a dry

air path is provided below the top cover 210 as slightly protruding in an outer lid path in which the outer lid 38 is to be suspended. Therefore, the outer lid 38 is moved away rearward in contact with the air passage member 518. The following consideration is given to ensure that the outer lid 38 can smoothly be moved away. An upper portion of the air passage member 518 is covered with a curved cover 519, so that a portion of the air passage member 518 to be brought into contact with the outer lid 38 is curved. The cover 519 is produced, for example, by bending a polypropylene resin sheet. Further, the outer lid 38 has a lower rigidity in a rear edge portion thereof than in a portion thereof forward of the rear edge portion. Although the outer lid 38 is structurally more liable to be bent inward and less liable to be bent (warped) outward (toward the front side), the rear edge portion of the outer lid 38 is designed so as to be easily warped.

Fig. 35 is a plan view illustrating the outer lid 38 as seen from the back side. As shown, some of the bar members 381 located in a rear portion of the outer lid 38 has a smaller length. More specifically, the second and sixth bar members 381 from the rearmost bar member each have a length which is about one third the length of the other bar members, so that the rear portion of the outer lid has a fish bone like shape. The rear portion

of the outer lid 38, which has a lower rigidity, is located within the rear cover 220 when the outer lid 38 is in a fully closed state and, therefore, is not seen from the outside. Even if (there is a possibility that) the air passage member 518 (provided as component on the outer tub) defining the dry air path partly protrudes in the outer lid path in which the outer lid 38 is suspended, the outer lid 38 can smoothly be moved away rearward in contact with the air passage member 518. This is because the rear portion of the outer lid 38 has a lower rigidity and is easily warped rearward, and the surface of the air passage member 518 to be brought into contact with the outer lid 38 is curved. Thus, the smooth opening and closing of the outer lid 38 can be ensured. If the protrusion of the air passage member 518 is very small, i.e., if the outer lid 38 is adapted to be slightly moved away rearward, it is merely necessary to provide the curved contact surface, or to reduce the rigidity of the rear portion of the outer lid 38.

Fig. 36 is a vertical sectional view illustrating the construction of the rear portion of the outer lid 38. As shown, a weight 520 is provided on the rear edge of the outer lid sheet 382 to tense the outer lid sheet 382. Thus, the outer lid sheet 382 is prevented from being raised (or undulated) when the outer lid 38 is slid.

The present invention is not limited to the embodiments described above, but various modifications may be made within the scope of the invention defined by the claims.

For example, the present invention is applicable to a drum-type laundry machine which does not have the oblique face 2B inclined with respect to the top face 2A.

Further, the axis of the drum 10 is not necessarily required to extend laterally, but may extend anteroposteriorly. In this case, the axis of the drum 10 is not necessarily required to extend generally horizontally, but may be inclined at an angle within a predetermined angular range (e.g., within about 30 degrees) with respect to a horizontal axis.

This application corresponds to the Japanese Patent Applications No. 2003-11378 filed on January 20, 2003, No. 2003-110134 filed on April 15, 2003 and No. 2003-170509 filed on June 16, 2003, in the Japanese Patent Office, and the entire disclosure of the Japanese applications are incorporated herein by reference.